

ELECTRICAL INSTRUMENTS

CIRCUIT BREAKERS

RELAYS

ROLLER-SMITH CO.

417 CHESTNUT ST.
PHILADELPHIA, PA.

RECEIVED
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

April 1, 1930.
(Superseding issue of April, 1929.)

PUBLICATIONS OF

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE
233 Broadway, NEW YORK



WORKS
Bethlehem, Penna.

Offices in Principal Cities in United States and Canada.
Representatives in Australia, Cuba, Japan and Philippine Islands.

ROLLER-SMITH products comprise complete lines of Electrical Instruments, indicating and graphic, Relays and air and oil Circuit Breakers. Bulletins covering the various devices will be sent promptly if you will check, sign and return this sheet.

SWITCHBOARD INSTRUMENTS

Check
Bulletins
Desired

D. C. Ammeters, Voltmeters and Volt-ammeters, 3½" and 4" sizes	Bulletin No. 400
A. C. Ammeters, Voltmeters and Wattmeters, 3½" and 4" sizes	" " 420
D. C. Ammeters, Voltmeters and Volt-ammeters, large sizes	" " 430
A. C. Ammeters, Voltmeters, Wattmeters, Power Factor Meters and Frequency Meters, large sizes	" " 450
Radio Frequency Ammeters, all sizes	" " 810
A. C. and D. C. Graphic Ammeters, Voltmeters, single phase and Polyphase Wattmeters and Power Factor Meters, Switchboard and Wall Types	" " 830

PORTABLE INSTRUMENTS

A. C. and D. C. Ammeters, Voltmeters, Volt-ammeters, Ohmmeters and Circuit Testers for signal system and train control apparatus testing	Bulletin No. 100
A. C. Ammeters, Voltmeters, Volt-ammeters, Wattmeters, Frequency Meters and Power Factor Meters, small and large sizes	" " 160
Rail Bond Testers	" " 200
D. C. Ammeters, Voltmeters, Volt-ammeters and Galvanometers, small and large sizes	" " 210
Precision Torsion Balances for weighing lamp filaments and other small bodies	" " 240
Ohmmeters and Circuit Testers	" " 300
A. C. and D. C. Graphic Ammeters, Voltmeters, Single Phase and Polyphase Wattmeters and Power Factor Meters, Portable type	" " 830

INSTRUMENT TRANSFORMERS

Portable types	Bulletin No. 160
Switchboard types	" " 450

AIR CIRCUIT BREAKERS

A. C. and D. C., Industrial Type, all styles of trips, 100 amperes and less	Bulletin No. 520
A. C. and D. C. Standard Type, all styles of trips, all ampere capacities	" " 530
A. C. and D. C., Enclosed Types, 800 amperes and less	" " 580

OIL CIRCUIT BREAKERS and Tripping Transformers

All styles of trip, hand and electrically operated, 15000 volts and less, 2000 amperes and less	Bulletin No. 600
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RELAYS

D. C. Relays, reverse current, etc.	Bulletin No. 550
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Name

Company

Address

City

State

Printed in U. S. A.

(See Other Side)

SWITCHBOARD

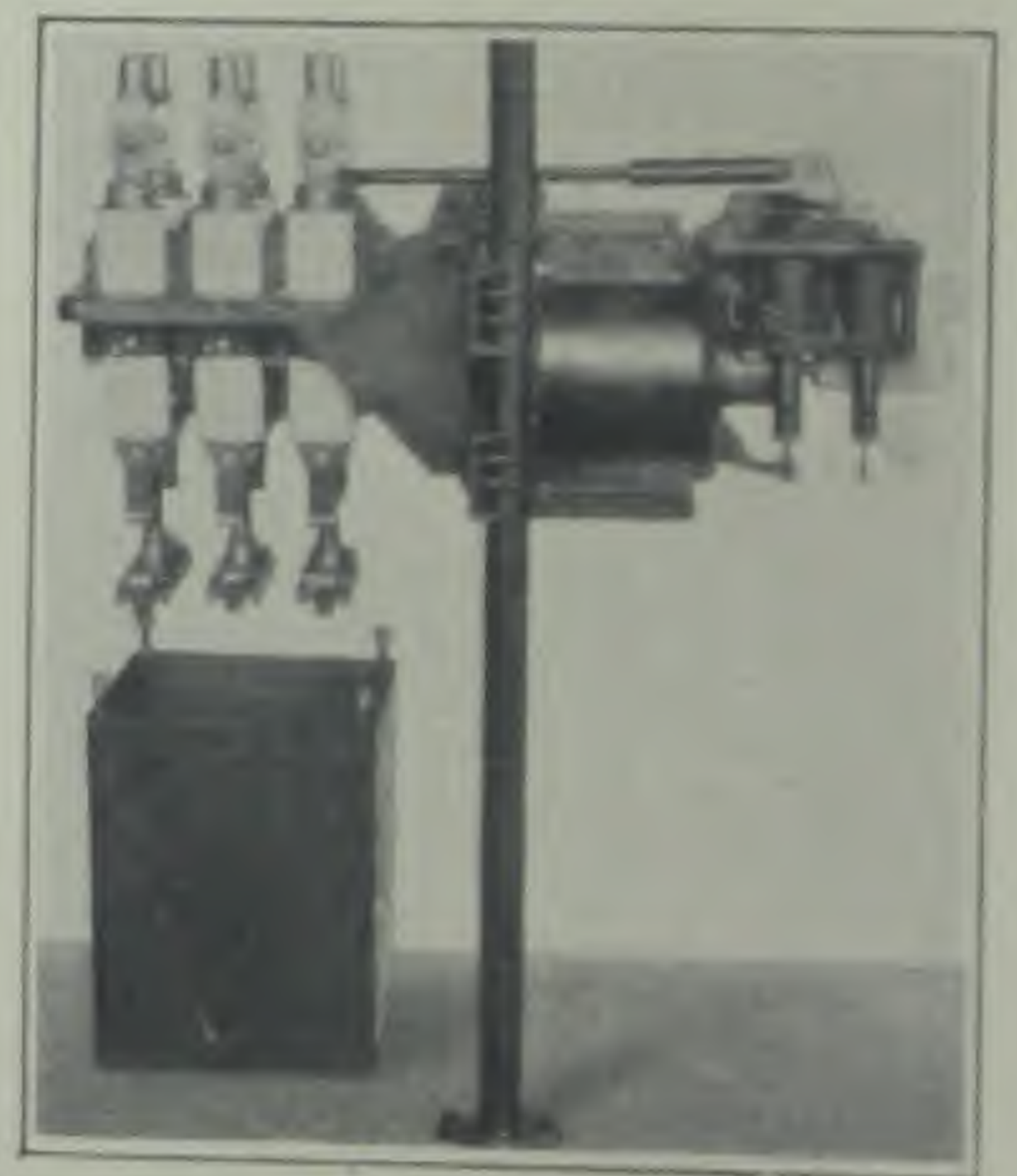
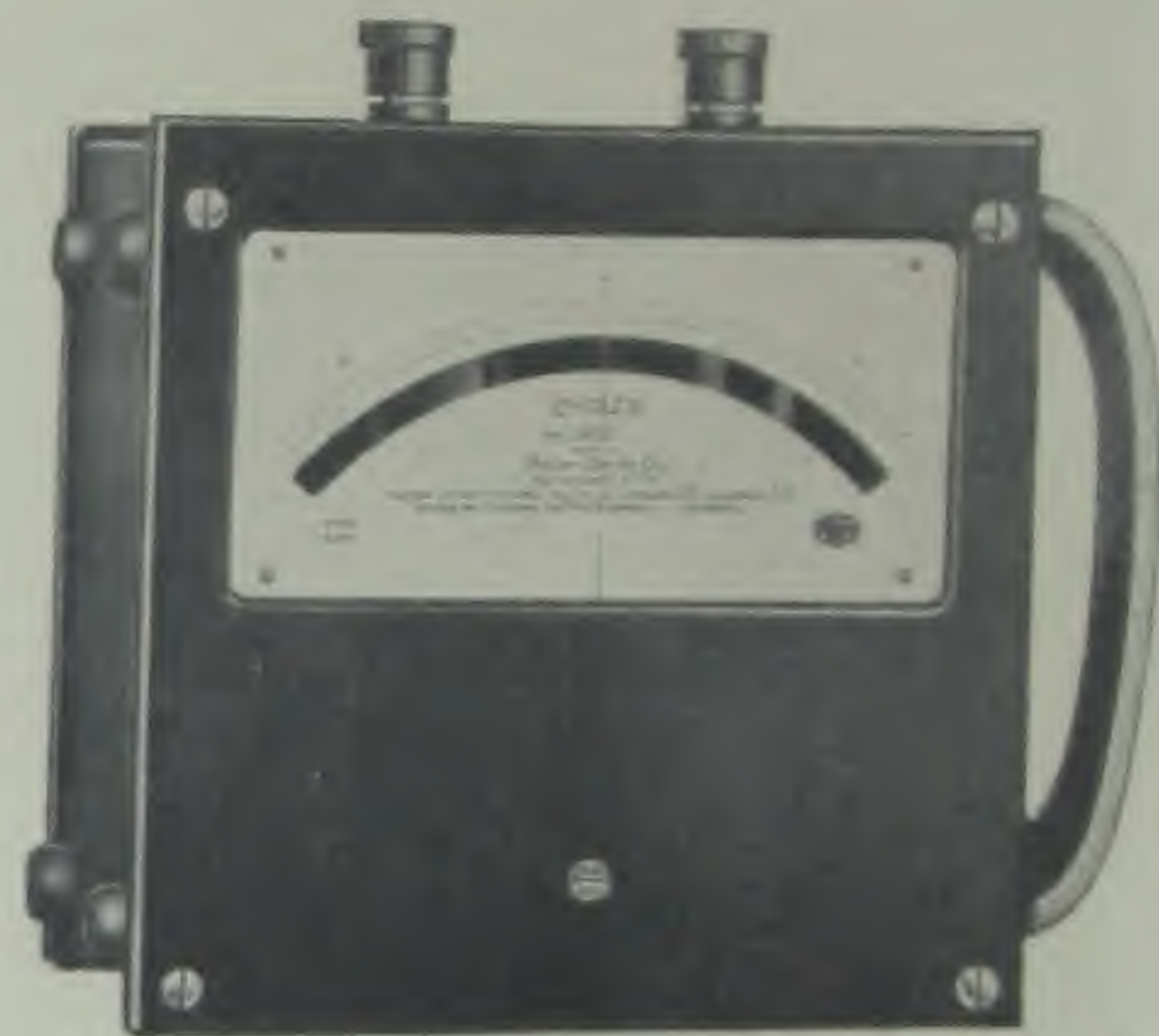
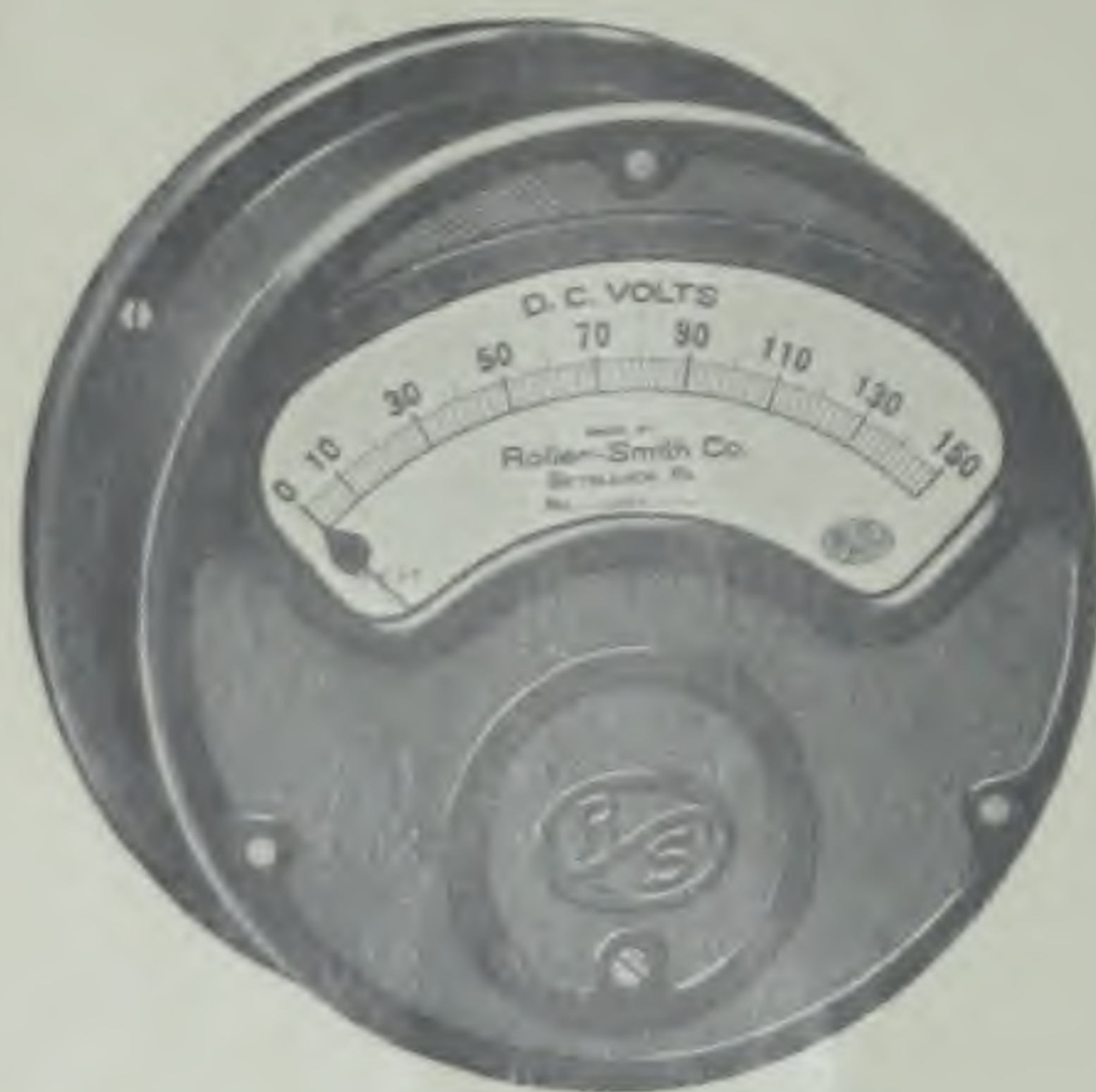
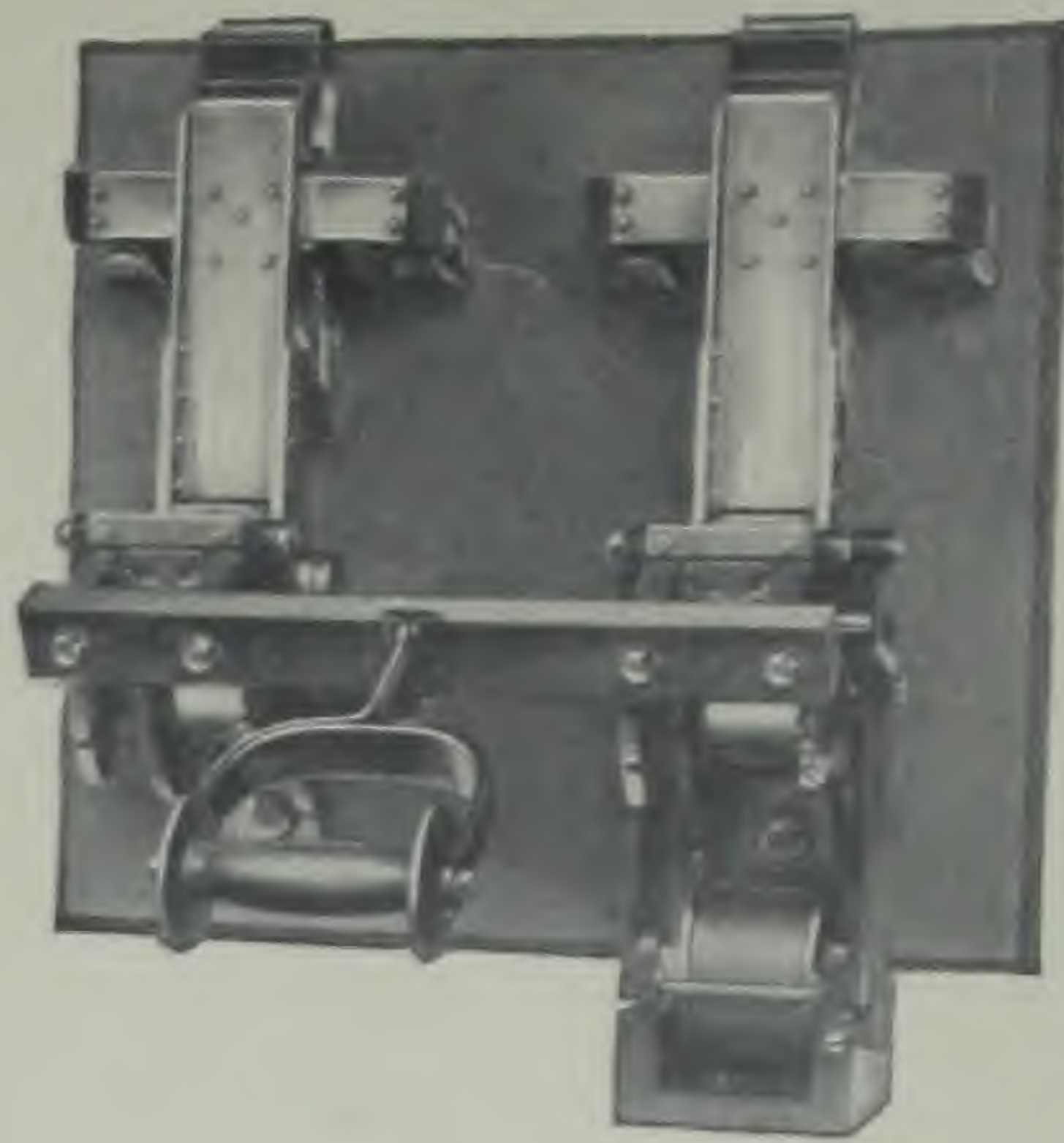
PORTABLE
INSTRUMENTS

AIR CIRCUIT
BREAKERS

RELAYS

Superseded by
Bulletin No. 445

A FEW OF THE MANY DIFFERENT DEVICES MADE BY ROLLER-SMITH COMPANY



GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned to, or to the Company's Works at Bethlehem, Pennsylvania, for that purpose.

ROLLER-SMITH POLICY

THE ROLLER-SMITH policy is to make and market electrical measuring and protective apparatus

Made of High Quality Materials

Embodying the Finest Engineering Skill

Selling at Reasonable Prices

Giving the Best Possible Service

It's an honest policy, carried out in an honest way. It forms the creed of every member of the Organization and has built up the Roller-Smith Company from "just another Company" to one of the leaders in the Art.

ROLLER-SMITH GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless, so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pennsylvania, for that purpose.

ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

Executive Offices and Export Dept.

233 Broadway, NEW YORK



WORKS

Bethlehem, Pennsylvania

SALES OFFICES

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 MANILA MACHINERY & SUPPLY CO., Manila, P. I.

SWITCHBOARD
INSTRUMENTS

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

CATALOG No. 48
July, 1930.



SWITCHBOARD INSTRUMENTS

DIRECT CURRENT

Ammeters, Milli-Ammeters, Voltmeters, Milli-Voltmeters,
Galvanometers, Pyrometers, Shunts

ALTERNATING CURRENT

Ammeters, Voltmeters, Single Phase and Polyphase Watt-
meters, Frequency Meters, Power Factor Meters, Three
Phase Ammeters

THERMO-COUPLE

Ammeters and Milli-Ammeters

CURRENT AND POTENTIAL TRANSFORMERS

SWINGING BRACKETS, MULTIPLIERS
and other Accessories

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

This Catalog No. 48 supersedes the following Bulletins:—

Bulletin No. 400, dated September, 1928.
Supplement No. 1 to Bulletin No. 400, dated May, 1929.
Bulletin No. 420, dated September, 1929.
Bulletin No. 430, dated July, 1929.
Price Sheet No. 1 to Bulletin No. 430, dated August, 1929.
Bulletin No. 450, dated March, 1928.
Supplement No. 1 to Bulletin No. 450, dated November, 1928.
Supplement No. 2 to Bulletin No. 450, dated June, 1929.
Price Sheet No. 1 to Bulletin No. 450, dated August, 1929.
Bulletin No. 810, dated August, 1929.

INTRODUCTORY

THIS new Catalog covers all ROLLER-SMITH switchboard instruments and instrument transformers.

GENERAL

We call particular attention to the wide variety of types and ranges listed in this Catalog—there is truly “an instrument for every need.” Having behind it an experience of over thirty years in the manufacture of fine instruments the ROLLER-SMITH COMPANY offers this line with the assurance that every detail of every instrument is in keeping with the exacting standards we have set up as our ideal. ROLLER-SMITH instruments are characterized by:

Efficient designs
The best of materials
Careful assembly
Accurate calibration
Thorough inspection

Added to the above is the inherent quality that is built into every instrument by a factory personnel that takes pride in its product; the fine facilities of a factory that was designed and constructed especially for the manufacture of ROLLER-SMITH apparatus and the honest guarantee that stands back of every ROLLER-SMITH product (see page 44).

SPECIAL INSTRUMENTS

We invite inquiries for special instruments not listed in these pages.

OTHER ROLLER-SMITH APPARATUS

In addition to the instruments listed in this Catalog the ROLLER-SMITH COMPANY makes a wide variety of portable indicating and graphic Instruments, air and oil Circuit Breakers and Relays. A complete list of all our publications will be sent on request.

INDEX

Design	Size	Accuracy	Current		Milli-Ammeters Ammeters Milli-Voltmeters Voltmeters	Pyrometers	Galvanometers	Single Phase and Polyphase Wattmeters	Frequency Meters & Power Factor Meters	Three Phase Ammeters
Round Pattern.....	3½"	1½%	D.C.	Type..	TD	.....	TD	.....	.....	.....
		1½%	A.C.	Page..	4	.....	4	.....	.....	.....
		1½%	R.F.	Type..	TA	.....	.....	.....	.....	.....
	4"	1½%	A.C.	Page..	18	.....	.....	.....	.....	.....
		1½%	R.F.	Type..	TW	.....	.....	.....	.....	.....
		1½%	R.F.	Page..	40	.....	.....	.....	.....	.....
	7½"	1½%	D.C.	Type..	FD	FD	FD	.....	.....	.....
		1½%	A.C.	Page..	6	7	5	.....	.....	.....
		1½%	R.F.	Type..	FA	.....	.....	FA	.....	.....
	9⅛"	1¼%	D.C.	Page..	19	.....	.....	20	.....	.....
		1¼%	A.C.	Type..	FW	.....	.....	.....	.....	.....
		1¼%	R.F.	Page..	41	.....	.....	.....	.....	.....
Rectangular	5⅝"x6"	1¼%	D.C.	Type..	SD	.....	.....	.....	.....	.....
		1¼%	A.C.	Page..	10	.....	.....	.....	.....	.....
Illuminated Dial	13¾"x 11⅝"	1¼%	D.C.	Type..	SA	.....	.....	SA	SA	B
		1¼%	R.F.	Page..	23	.....	.....	24	25	37
Horizontal Edgewise....	9½"x 5½" 8⅜"x 9⅝" (For HEA-3)	1¼%	D.C.	Type..	STW	.....	.....	.....	.....	.....
		1¼%	A.C.	Page..	41	.....	.....	.....	.....	.....
Rectangular	5⅝"x6"	1¼%	D.C.	Type..	ND	.....	.....	.....	.....	.....
		1¼%	A.C.	Page..	12	.....	.....	.....	.....	.....
Illuminated Dial	13¾"x 11⅝"	1¼%	D.C.	Type..	NA	.....	.....	NA	NA	.....
		1¼%	R.F.	Page..	29	.....	.....	30	31	.....
Horizontal Edgewise....	9½"x 5½" 8⅜"x 9⅝" (For HEA-3)	1¼%	D.C.	Type..	RD	.....	.....	.....	.....	.....
		1¼%	A.C.	Page..	11	.....	.....	.....	.....	.....
Rectangular	5⅝"x6"	1¼%	D.C.	Type..	RA	.....	.....	RA	RA	.....
		1¼%	A.C.	Page..	26	.....	.....	27	28	.....
Illuminated Dial	13¾"x 11⅝"	1¼%	D.C.	Type..	IDD	.....	.....	.....	.....	.....
		1¼%	R.F.	Page..	14	.....	.....	.....	.....	.....
Horizontal Edgewise....	9½"x 5½" 8⅜"x 9⅝" (For HEA-3)	1¼%	D.C.	Type..	HED
		1¼%	A.C.	Page..	13
Rectangular	5⅝"x6"	1¼%	D.C.	Type..	HEA	HEA	HEA	HEA-3
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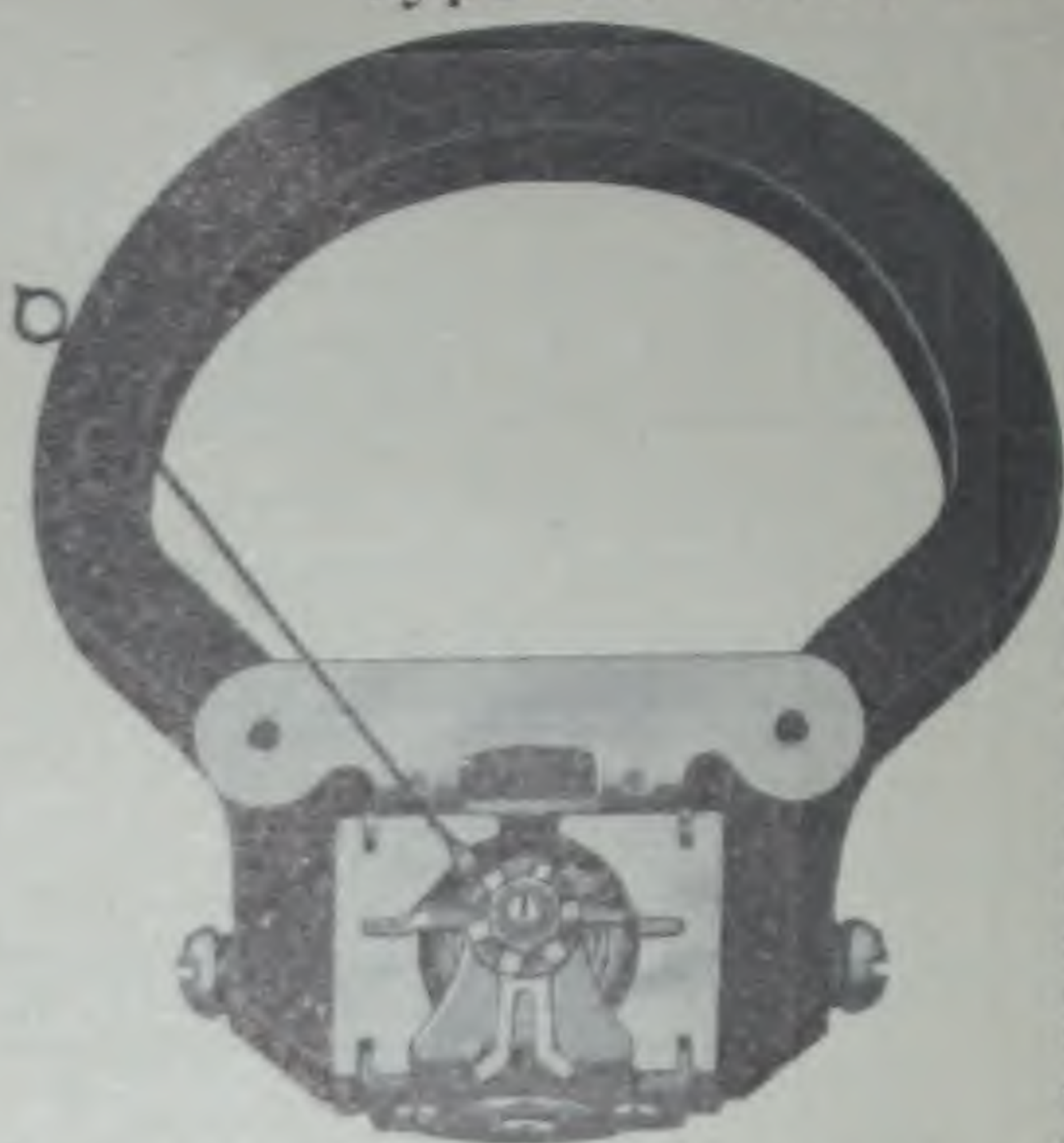
PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

Direct Current Switchboard Instruments

Type TD (3½") and Type FD (4")



Reference to the illustrations will show the **pleasing appearance** of these instruments and the open, well lighted and **extremely long scales**.

TYPE TD

For **surface mounted** instruments the Type TD case is made of molded bakelite. The advantages of this material for an instrument case are many. Permanent finish, highest insulating qualities and freedom from corrosion are a few of the superior qualities that a bakelite case possesses. All TD instruments are equipped with bases made from molded bakelite, which insures highest insulating qualities and freedom from warpage. Square shouldered studs are set in square sockets, molded in the base, which absolutely eliminates the possibility of studs being twisted around and breaking internal connections. **Surface mounted metal cases**, either with or without base

flange, as may be specified, can be furnished on special order without extra charge when called for. **Flush metal and bakelite cases** can be supplied without extra charge when specified.

Type TD voltmeters have self-contained resistances up to and including 150 volts. For 300 volt instruments an external resistor in the form of a flat disc is supplied, such discs being supported by the studs of the instrument. For ranges between 300 volts and 1000 volts larger forms of resistors are used, which are built in cylindrical containers, which can be secured to the switchboard or panel by appropriate screws. For potentials of 1000 volts and over a special, highly insulated external resistor is employed.

TYPE FD

Type FD instruments are supplied in the surface type only and cases are of metal with our well known black rubberoid finish. Bases are of metal, strong and rigid.

Front connected Type FD instruments can be supplied on special order at an extra charge. Correspondence regarding such is invited.

Type FD voltmeters up to 300 volts have self-contained resistors and above that separately mounted resistors are used. These resistors are of the cylindrical type for potentials under 1000 volts. For potentials over 1000 volts a special, highly insulated resistor is used.

GENERAL

All instruments are **dust and moisture proof**. When we are advised that instruments are to be used under damp or tropical conditions special precautions are taken to adapt the instruments to those conditions.

Connections are in the form of rear studs so arranged that they cannot turn and a full complement of nuts and washers is supplied. In mounting a surface instrument it is necessary to drill only the holes for the studs which studs are provided with holding nuts to secure the instrument firmly in place. A **flush type** instrument is held in place by means of screws in the mounting holes in the rim.

The **magnetic damping**, which is characteristic of the d'Arsonval type of mechanism, insures "dead beat" action of the moving element.

Dials are of pure white bristol-board of the highest grade. Non-fading black India ink, which retains its legibility indefinitely, is used in all types. Dials with special markings will be supplied on quantity propositions without extra charge.

Glasses are free from flaws and are firmly fastened in place.

Springs are of phosphor-bronze, well aged to minimize zero shifting.

Mechanisms are mounted on the bases in such a manner that strains and stresses on either the base or the case are not transmitted to the moving element.

All mechanisms are of the d'Arsonval (permanent magnet, moving coil) type. Scale divisions are uniform.

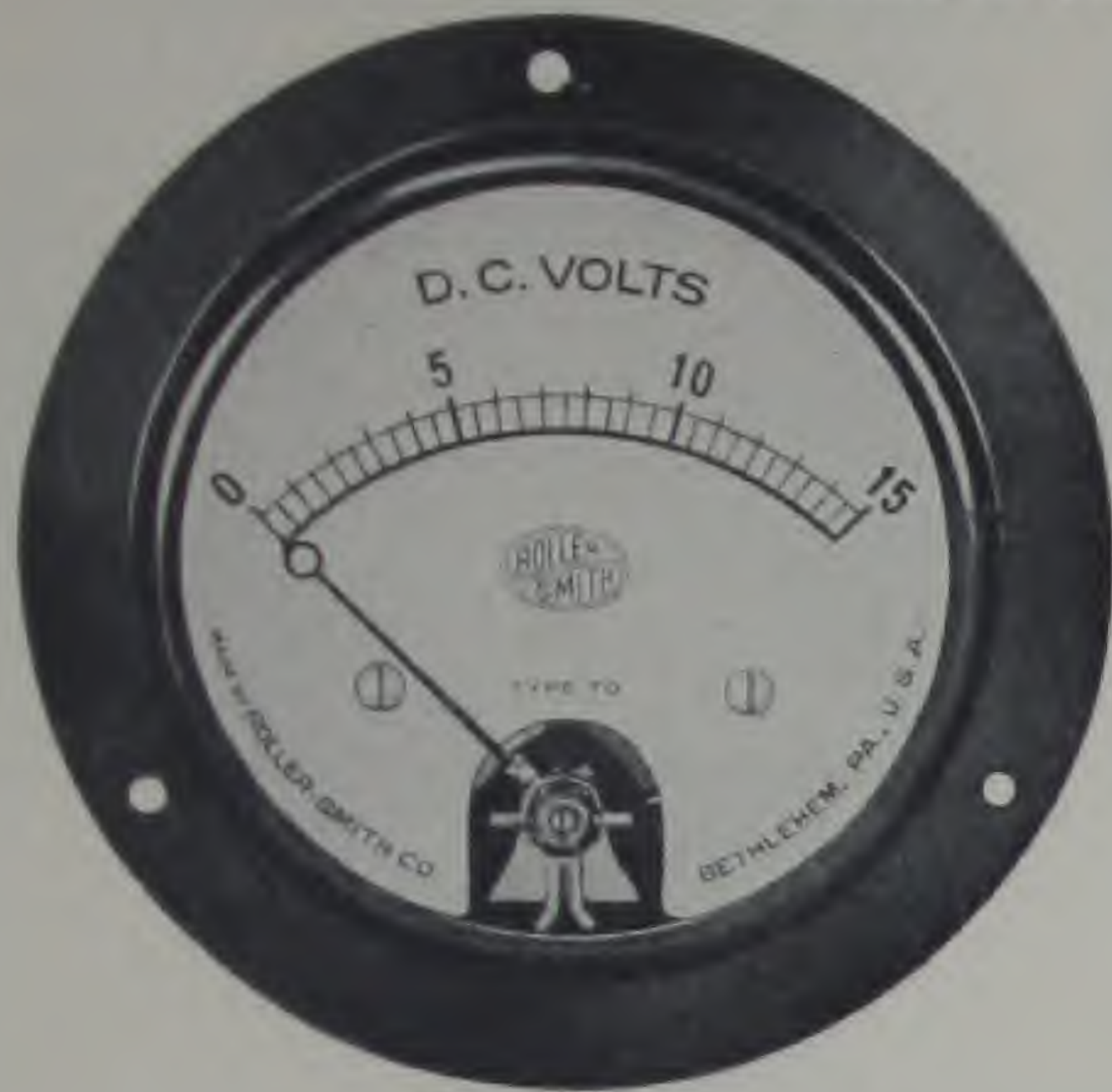
All Type FD instruments are regularly equipped with **zero adjusters** and Type TD instruments will be so equipped without extra charge on special order.

All left zero instruments are **accurate** within 1½% of full scale value at any point on the scale. On special order and without extra charge any instrument will be calibrated with highest possible accuracy at any particular point.

Type TD

(3½" Diameter)

Ammeters and Voltmeters



Flush Model

Type TD instruments are recommended for all applications where an instrument of very small size is desired. Diameter overall is 3½", body diameter 2⅝" for metal cases and 2¾" for flush bakelite cases and depth (not including studs) is 1⅝" for the surface model and 1⅜" (behind the flange) for the flush model. Net weight is 10 ounces, shipping weight 1 pound. See Page 8 for detailed dimensions. Scale is 2.1" long.

MILLI-AMMETERS

AMMETERS

Cat. No.	Range	Value Per Division	List Price	Cat. No.	Range	Value Per Division	List Price
4095	.5-0-.5 M.A.	.025 M.A.	\$13.00	4082s	0-50 M.V., with 3 foot leads	Scale to suit shunt	\$11.60
4093	0-1	.025	13.00	4035	0-1 Amp.	.025 Amp.	10.60
4058s	0-5	.2	13.00	4041	0-1.5 Amps.	.05	10.60
4059s	0-10	.25	10.60	4036	0-3	.1	10.60
4033s	0-15	.5	10.60	4000s	0-5	.2	10.60
4061s	0-25	1.0	10.60	4001s	0-10	.25	10.60
4027s	0-50	2.0	10.60	4003s	0-15	.5	10.60
4031s	0-100	2.5	10.60	4005s	0-20	.5	10.60
4089	0-150	5.0	10.60	4007s	0-30	1.0	10.60
4090	0-200	5.0	10.60	4009s	0-40	1.0	10.60
4091	0-300	10.0	10.60	4083s	0-50	2.0 Amps.	10.60
4092	0-400	10.0	10.60	4080	0-60	2.0	13.00
4026s	0-500	20.0	10.60	4081	0-80	2.0	13.00
4052	0-800	20.0	10.60	*4015s	0-100	2.5	17.00
				*4084s	0-150	5.0	17.00
				*4065s	0-200	5.0	17.00

Cat. No. 4094s Type TD galvanometer, scale 10-0-10 divisions, 15 micro-amperes per division, resistance approximately 55 ohms..... \$15.00 List

* External 50 M.V. shunt and 3 ft. leads.
"s" indicates stock item.

Center-zero ammeters and milli-ammeters can be supplied at the same list prices as the left-zero instruments listed. Note that on center-zero instruments the value per scale division is usually double that of left-zero instruments.

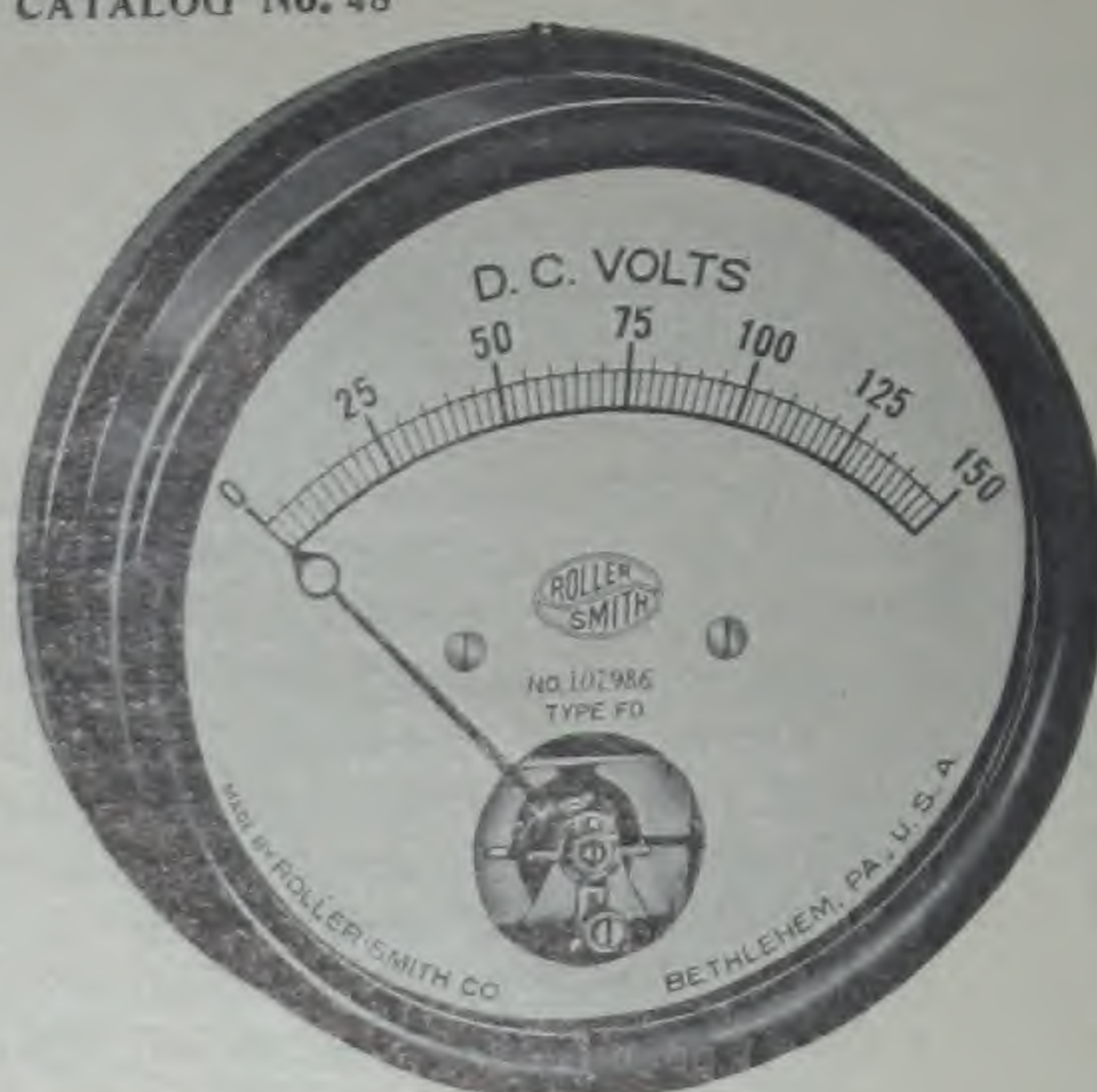
MILLI-VOLTMETERS

VOLTMETERS

Cat. No.	Range	Value Per Division	List Price	Cat. No.	Range	Value Per Division	List Price
4085s	0-50 M.V.	2.0 M.V.	\$10.60	4018s	0-15 Volts	.5 Volt	\$10.60
4037	0-150	5.0	10.60	4087s	0-20	.5	10.60
4038	0-250	10.0	10.60	4019s	0-30	1.0	10.60
4039	0-500	20.0	10.60	4020s	0-50	2.0 Volts	10.60
VOLTMETERS				4088s	0-75	2.5	10.60
4040s	0-1.5 Volts	.05 Volt	10.60	4068s	0-100	2.5	10.60
4016s	0-3	.1	10.60	4022s	0-150	5.0	14.00
4086s	0-5	.2	10.60	†4043s	0-300	10.0	17.00
4017s	0-10	.25	10.60				

† Cat. No. 4043 has external resistor.
"s" indicates stock item.

In ordering specify quantity, catalog number and whether flush or surface model. Surface model always furnished unless otherwise specified.



Type FD (4" Diameter)

Ammeters and Voltmeters

The Type FD instruments are adapted especially to applications where one desires an instrument larger than the Type TD but not as large as the conventional 7½" size. Diameter overall is 4" and depth (not including studs) is 1¾". Average net weight is 17 ounces and shipping weight 3 pounds. See page 8 for detailed dimensions. Scale is 2¾" long.

MILLI-AMMETERS

Cat. No.	Range in Amperes	Value Per Scale Division	List Price
4178	.5-0-.5 M.A.	.02 M.A.	\$18.50
4176	0-1	.02	18.50
4129	0-5	.1	16.00
4131	0-10	.2	13.50
4133	0-15	.25	13.50
4135	0-25	.5	13.50
4125	0-50	1.0	13.50
4163	0-75	1.0	13.50
4105	0-100	2.0	13.50
4171	0-150	2.5	13.50
4172	0-200	5.0	13.50
4173	0-300	5.0	13.50
4174	0-400	10.0	13.50
4101	0-500	10.0	13.50
4137	0-800	20.0	13.50

AMMETERS

Cat. No.	Range in Amperes	Value Per Scale Division	List Price
4160s	50 M.V. capacity with 3 ft. leads	Scale to suit shunt	\$14.50
4100	0-1 Amp.	.02 Amp.	13.50
4147	0-1.5 Amps.	.025	13.50
4102	0-3	.05	16.50
4104	0-5	.1	16.50
4106s	0-10	.2	16.50
4110s	0-15	.25	16.50
4164	0-20	.5	16.50
4114s	0-30	.5	16.50
4165	0-40	1.0	16.50
4118s	0-50	1.0	16.50
4166	0-60	1.0	16.50
4175s	0-80	2.0 Amps.	20.00
*4126s	0-100	2.0	20.00
*4130s	0-150	2.5	20.50
*4134s	0-200	5.0	21.50

Cat. No. 4177; Type FD Galvanometer, scale 10-0-10 divisions, 15 micro-amperes per division, resistance approximately 55 ohms..... \$18.50 List

* External 50 M.V. shunt and 3 ft. leads.
"s" indicates stock item.

Center-zero ammeters and milli-ammeters can be supplied at the same list prices as left-zero instruments. Note that the value per scale division on center-zero instruments is usually twice that of left-zero instruments.

MILLI-VOLTMETERS

Cat. No.	Range in Volts	Value Per Scale Division	List Price
4149s	0-50 M.V.	1.0 M.V.	\$13.50
4167	0-150	2.5	13.50
4153	0-250	5.0	13.50
4155	0-500	10.0	13.50

VOLTMETERS

4157s	0-1.5 Volts	.025 Volt	13.50
4140s	0-3	.05	13.50
4168s	0-5	.1	14.00
4142s	0-10	.2	14.00

VOLTMETERS

Cat. No.	Range in Volts	Value Per Scale Division	List Price
4144s	0-15 Volts	.25 Volt	\$14.00
4169s	0-20	.5	14.00
4146s	0-30	.5	14.50
4148s	0-50	1.0	14.50
4170s	0-75	1.0	16.00
4151s	0-100	2.0 Volts	16.00
4154s	0-150	2.5	16.00
4158s	0-300	5.0	22.00

"s" indicates stock item.

DIRECTIONS FOR ORDERING: Specify quantity and catalog number. Front connected instruments can be supplied on special order and at an extra charge. Details on request. Type FD combination volt-ammeters can be supplied. Prices on application.

Type FD (4") Pyrometers



The Type FD Pyrometer outfit consists, in brief, of a pyrometer 4" in diameter, connected by suitable leads to a thermo-couple, mounted in a special casing, adapted for submersion in molten type metal such as is used in various kinds of type casting machines.

APPLICATION

This pyrometer has proved immensely superior to the glass tube thermometer, which has been used largely for checking the temperature of type metal in Linotype, Monotype and other similar type casting equipment. The disadvantages of the glass type of thermometer for indicating the temperature on type casting machines are threefold:

1. It is not usually convenient nor possible to read the glass thermometer from any distance with the result that there is always the temptation on the part of the operator to slight this highly important duty.
2. Glass thermometers are fragile and the breakage runs high even under most careful usage.
3. Heating beyond the range of a glass thermometer ruins it, while the pyrometer suffers no injury from overheating.

The Type FD Pyrometer is mounted upon a support in plain view of the operator and there is no excuse for his not being always aware of the temperature of the metal in type pot. The thermo-couple element is encased in a heavy iron cylinder which is not fragile and can be left imbedded in cold type metal without injury. In addition to the foregoing superiority of the FD pyrometer over the glass tube thermometer, the scale is more legible and can be read by an operator standing twelve feet away from the instrument, which means that the operator of another machine can keep his eye on the temperature of the type metal without losing time. Moreover, the FD pyrometer can be mounted at any convenient height and angle for the operator, a feature which, of course, is impossible with the glass thermometer, which usually has to be lifted out of the type metal pot for a reading and then replaced.

DESCRIPTION

The Roller-Smith FD Pyrometer consists of an exceptionally rugged D'Arsonval type of milli-voltmeter, calibrated to read temperatures from 0 to 1200 degrees F. The scale is graduated to read in 20 degree divisions. The dial is of white bristol board with black inscriptions. The moving element of the instrument is carried on polished steel pivots

working in the highest grade Ceylon sapphire jewels. Wherever possible the moving parts are made of aluminum and in accordance with the best practices of electrical instrument design. Every effort has been made to secure ruggedness, which is so essential in an instrument that may be mounted on a machine subject to constant vibration. The instrument case is finished in black rubberoid, baked-on enamel, which gives a finish exceptionally durable and proof against scratches, corrosive action of gas fumes, etc.

ACCURACY

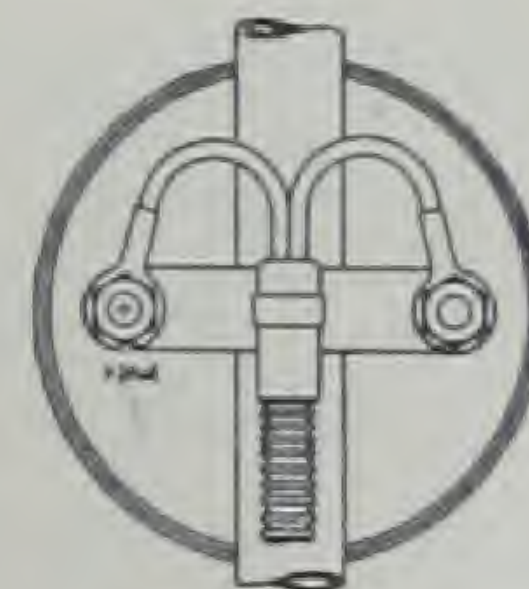
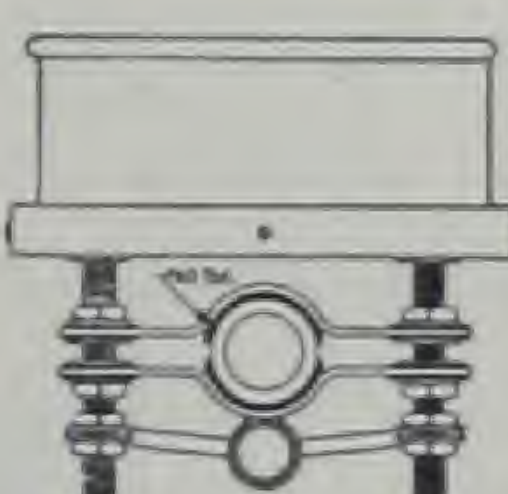
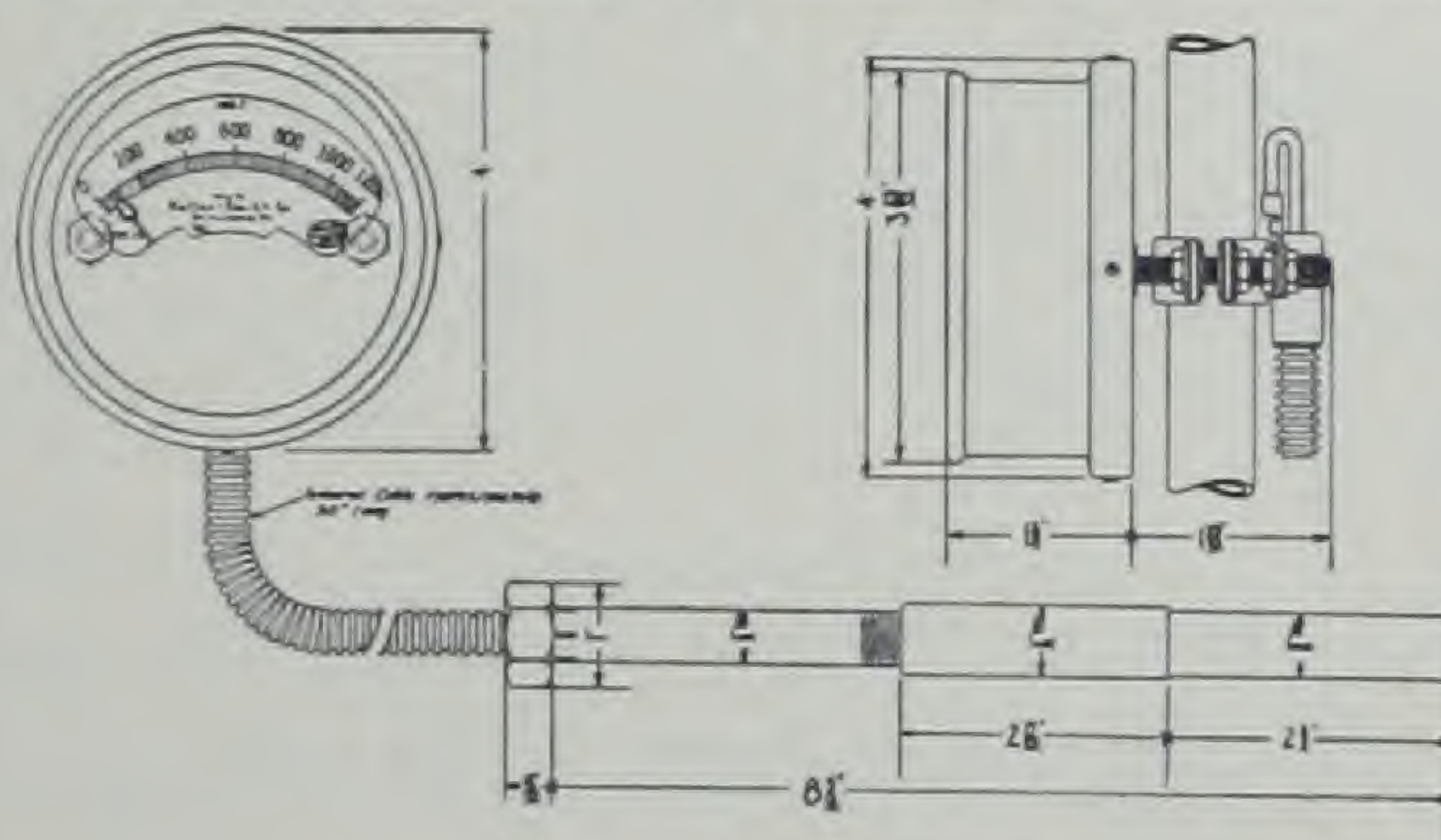
The R-S FD Pyrometer is guaranteed to be accurate to within one scale division, i.e., 20 degrees F. at any point of the scale and at the working point where the highest accuracy is necessary, this usually being the 800 degree point, the accuracy is guaranteed to be within 15 degrees F., plus or minus.

THERMO-COUPLE

The thermo-couple casing consists of a $\frac{1}{2}$ " tube 9" in length. This may be inserted into the type metal pot up to a flange, which is permanently secured $5\frac{1}{4}$ " from the fire end. A section of armored tubing is built into the couple, protecting the instrument leads up to the point where they are attached to the instrument terminals.

MOUNTING

The instrument is equipped with a mounting clamp by which it may be fastened against a vertical iron pipe that can be attached to the type casting machine or the clamp can be passed around any convenient pipe or conduit not attached to the machine, which happens to be in close proximity to it. If no pipe or conduit is available the instrument can be mounted on a simple little panel, which any one can readily make up and can be attached to a nearby wall or other support. The thermo-couple can be placed vertically in the type metal pot and, for convenience, most users fasten a little strap of iron to the edge of the pot having a hole in the inner end sufficient to clear the thermo-couple. In this fashion the thermo-couple is kept located at the portion of the type metal receptacle having the greatest depth and constancy of readings is thus assured. The dimensions of the support iron vary with different types of machines. We do not furnish these iron straps but they can easily be made up by the user.

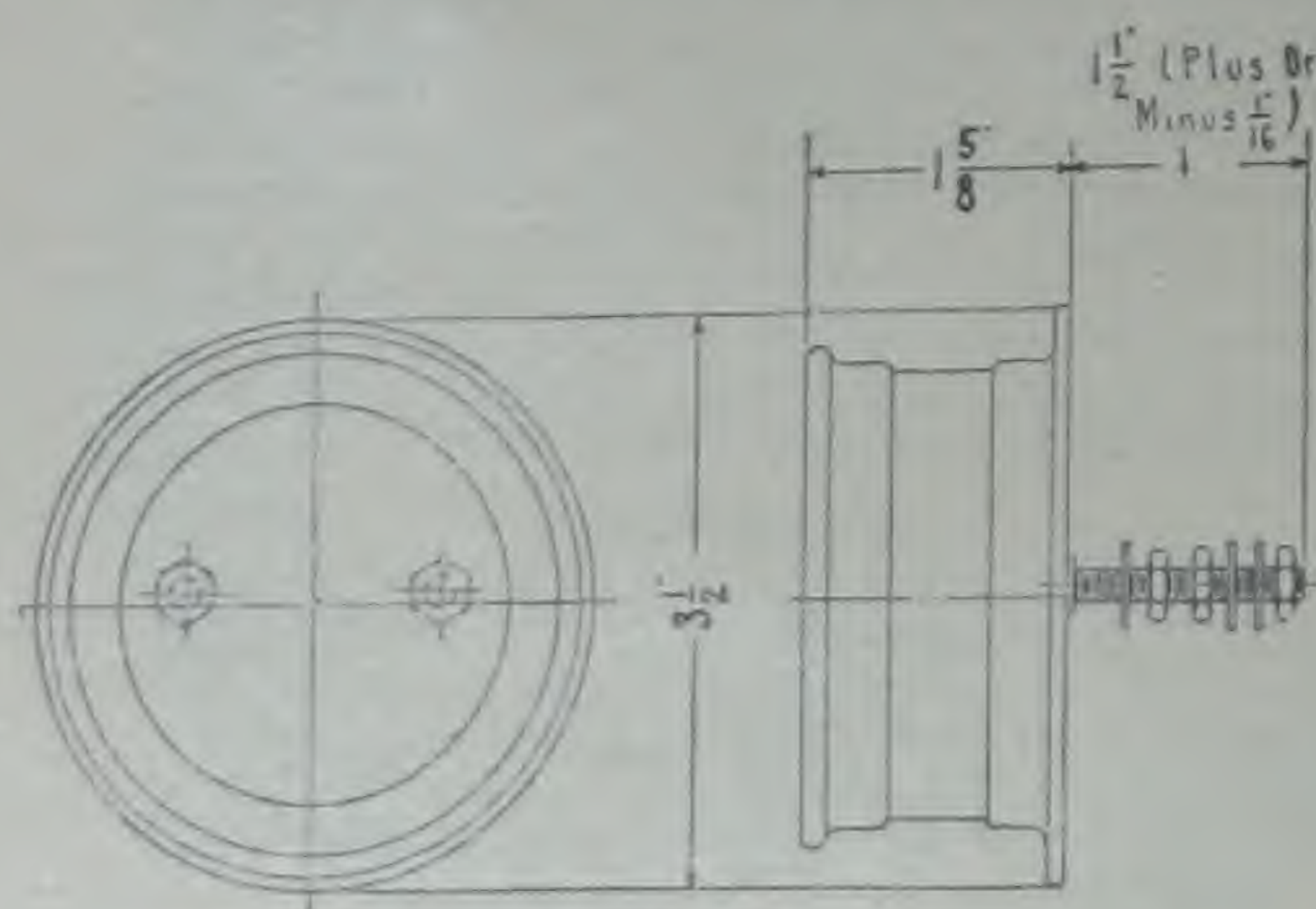


DW-12472

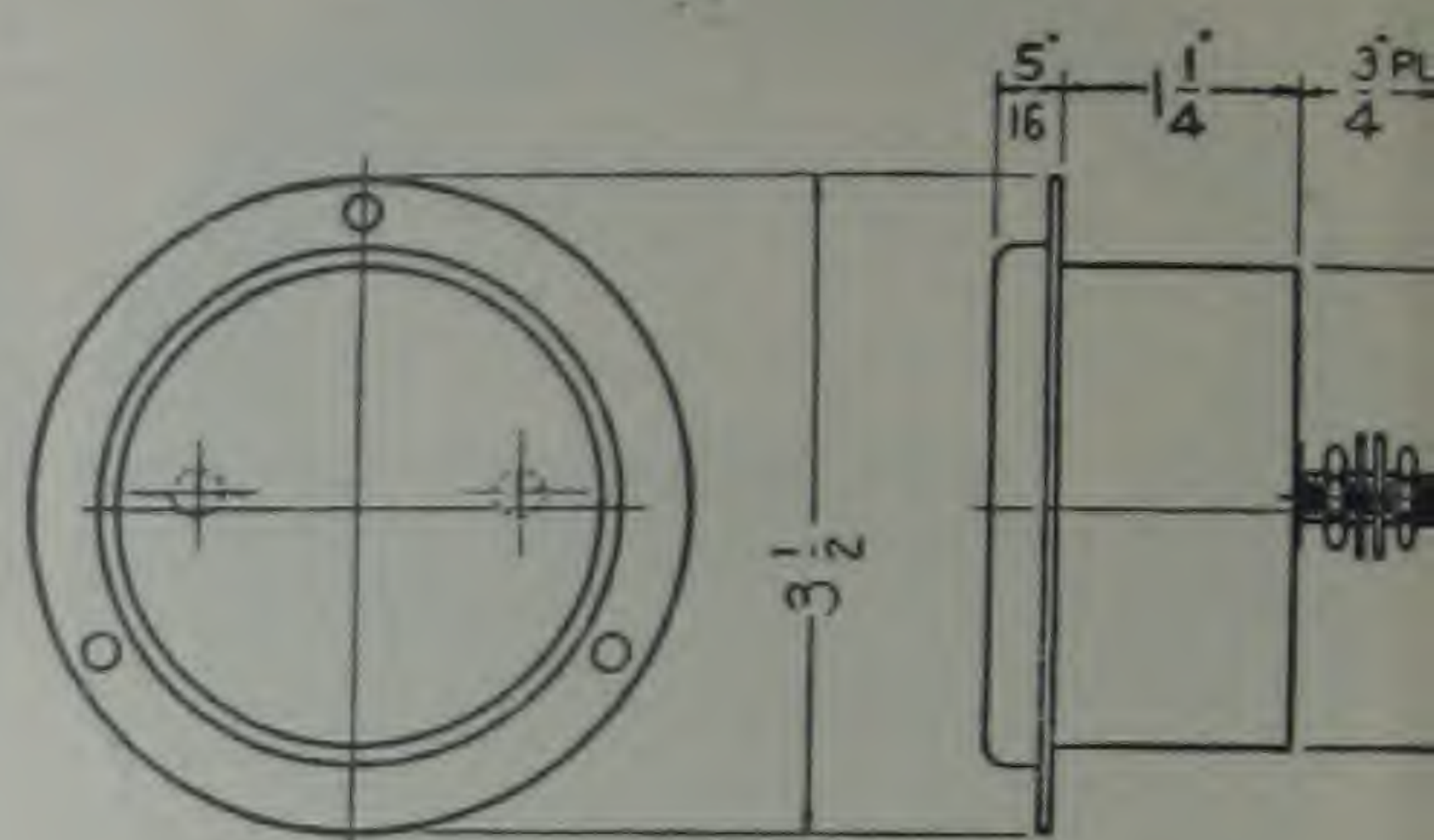
Cat. No.	Description	List Price
4190	Type FD Pyrometer, complete with thermo-couple, leads and clamp	50.00

Directions for Ordering: Specify quantity and catalog number.

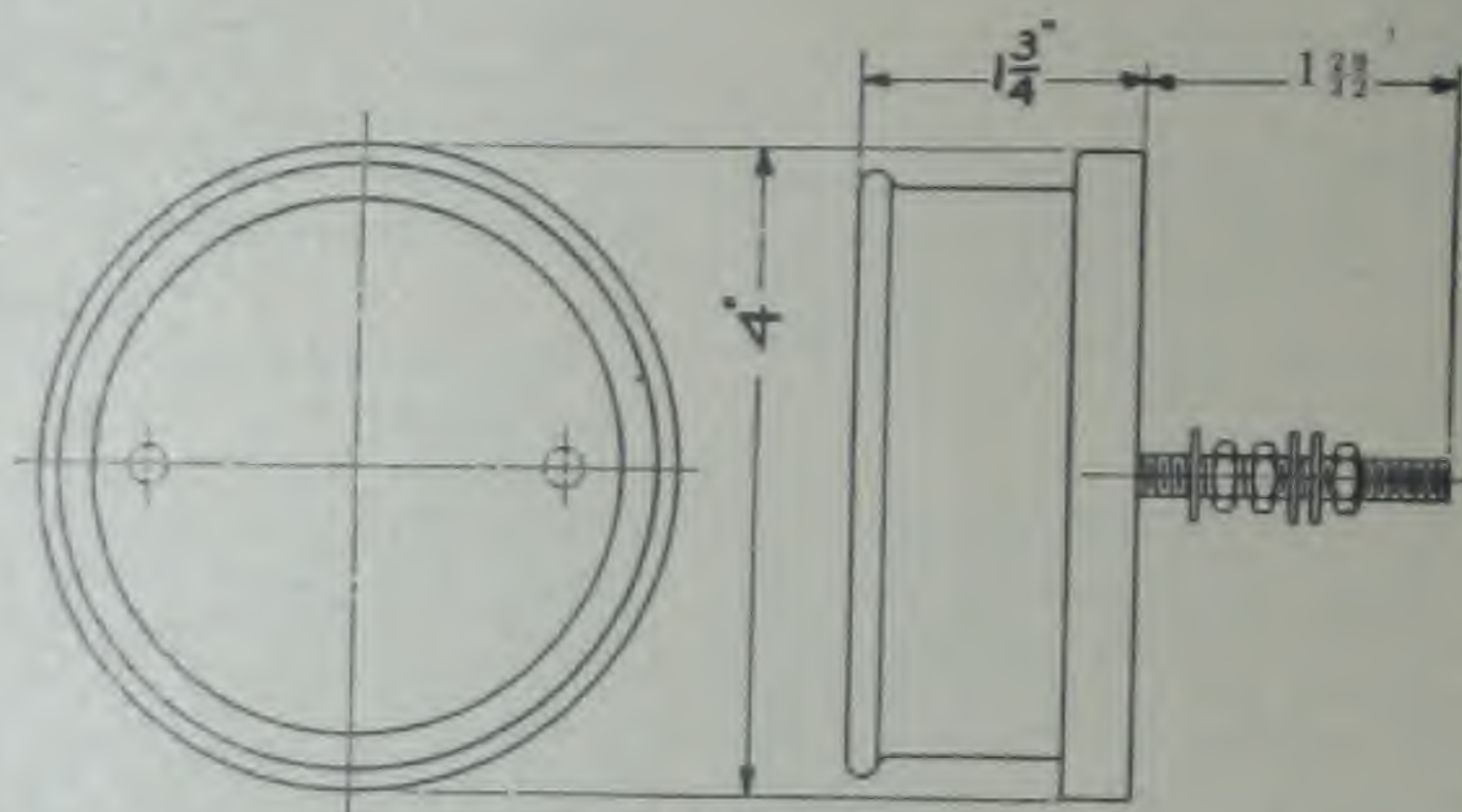
Dimensions of Types TD and FD Instrument



TYPE TD
Ammeter or Voltmeter—Surface Model
Net Weight $\frac{3}{4}$ lb. Shipping Weight 1 lb.

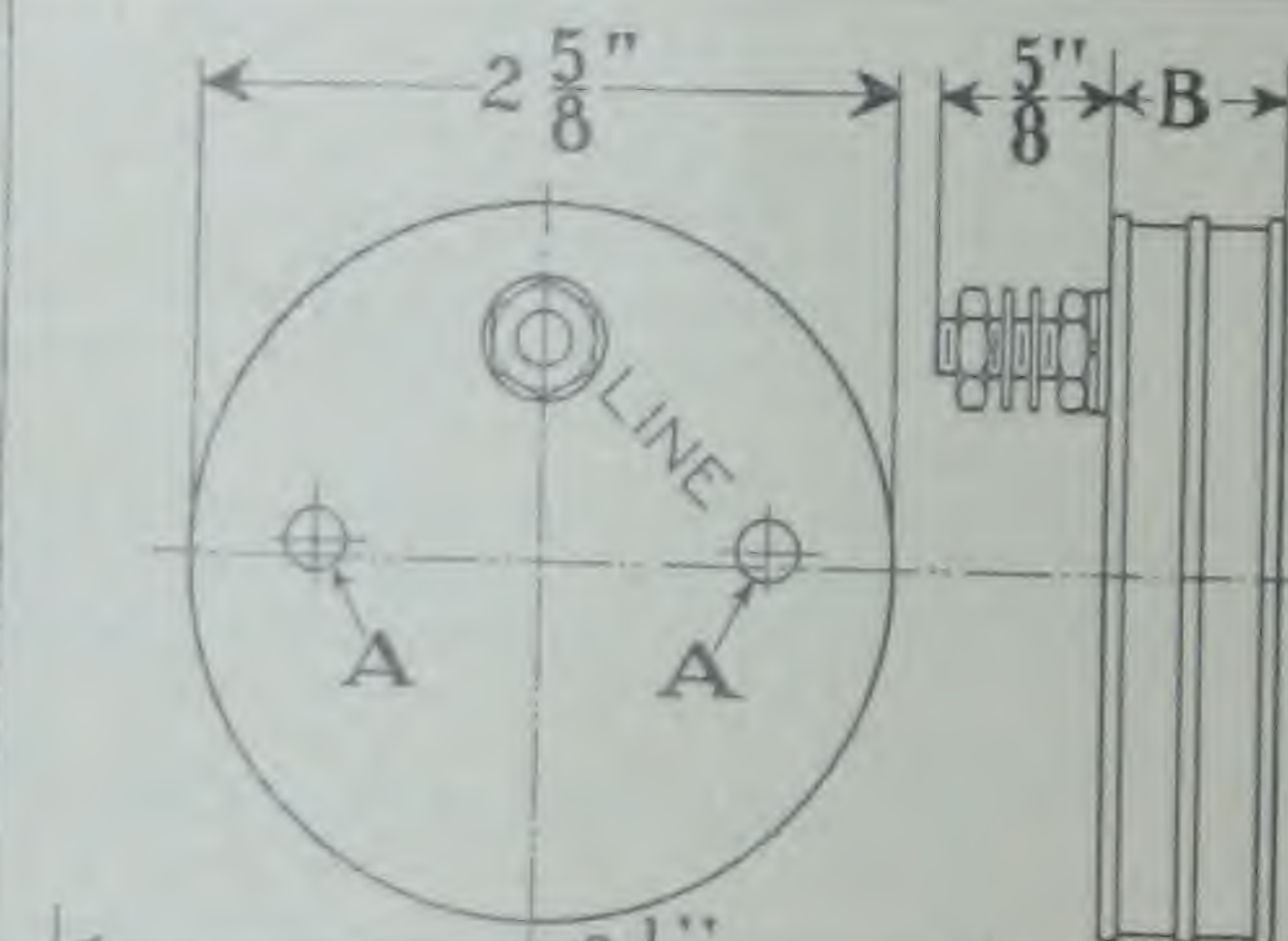


TYPE TD
Ammeter or Voltmeter—Flush Model Meta
Net Weight $\frac{3}{4}$ lb. Shipping Weight 1
(Note:—Flush bakelite case has body dia.



TYPE FD
Ammeter or Voltmeter—Surface Model
Net Weight $1\frac{1}{4}$ lbs. Shipping Weight $1\frac{1}{2}$ lbs.

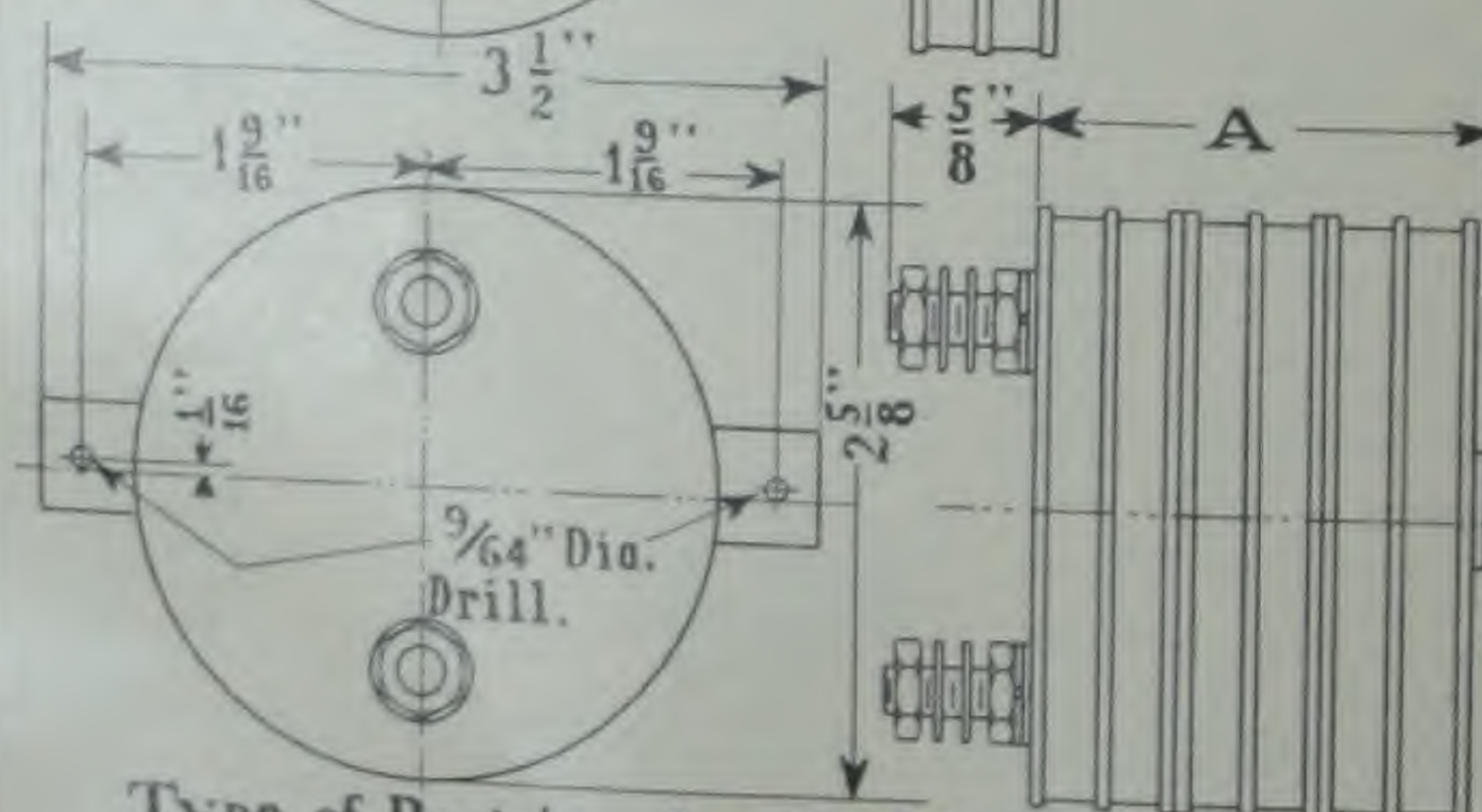
All Dimensions are Approximate and for
Reference Purposes only.



Holes A-A fit over Instrument Stud

Dim. B: $\frac{5}{8}$ " for 300 Volts
 $1\frac{1}{4}$ " for 500 Volts

Disc Type Resistor for TYPE T
Voltmeters, 0-300 Volts and 0-500 Volts

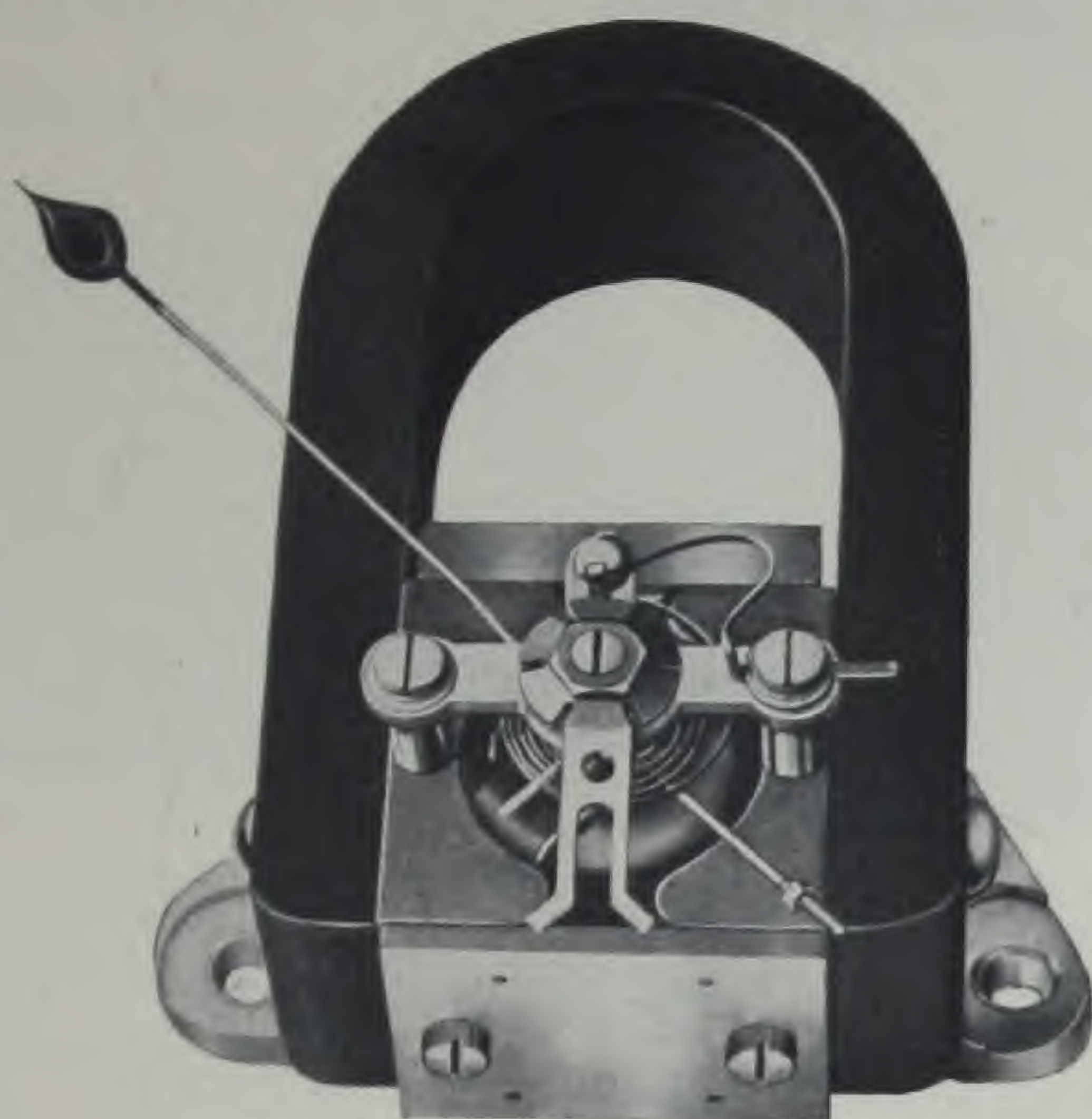


Dim. A:
 $1\frac{5}{16}$ " for 500 to 750 Volts
 $1\frac{13}{16}$ " for 1000 Volts,
 $3\frac{3}{16}$ " for 1500 Volts,
 $3\frac{13}{16}$ " for 2000 Volts
and $5\frac{1}{16}$ " for 2500 Volts

Type of Resistor for TYPE T D Voltmeter, 1000 to 2000 Volts
and TYPE F D Voltmeters, 500 to 2500 Volts

Direct Current Switchboard Instruments

Types SD, RD, ND, HED and IDD



On this page we give the essential details that are common to all the instruments on pages 10, 11, 12, 13 and 14 (except as noted).

Reference to the illustrations will show the pleasing appearance of these instruments and the open, well lighted and easily read scales.

Our well-known black rubberoid finish has been adopted as standard after many years of experience with various finishes. It is durable and will not tarnish or oxidize. Special finishes can be supplied at an extra charge and prices will be noted on application.

Sturdy—but light—steel cases are standard and all instruments are dust and moisture proof. When we are advised that instruments are to be used under damp or tropical conditions special precautions are taken to adapt the instruments to those conditions. Flush type instruments can be furnished in certain types—see listings for details.

Connections (for back connected instruments) are in the form of rear studs so arranged that they cannot turn and a full complement of nuts and washers is applied. In mounting an instrument it is necessary to drill only the holes for the studs which studs are provided with holding nuts to secure the instrument firmly in place. **Front connected** instruments can be supplied in certain types—see listings for details.

Magnetic damping insures “dead beat” action of the moving element.

Dials (except for the Type IDD) are of pure white bristol board of the highest grade and the scales are drawn in by hand in accordance with the characteristics of each instrument. Non-fading black India ink, which retains its legibility indefinitely, is used in all types.

Glasses are free from flaws and are firmly cemented in place.

Types SD, RD, ND and IDD instruments are provided with a convenient and efficient zero adjuster.

Springs are of phosphor-bronze, well aged to minimize zero shifting.

Mechanisms are so mounted that the parts cannot get out of alignment.

All mechanisms are of the permanent magnet, moving coil type. Scale divisions are uniform.

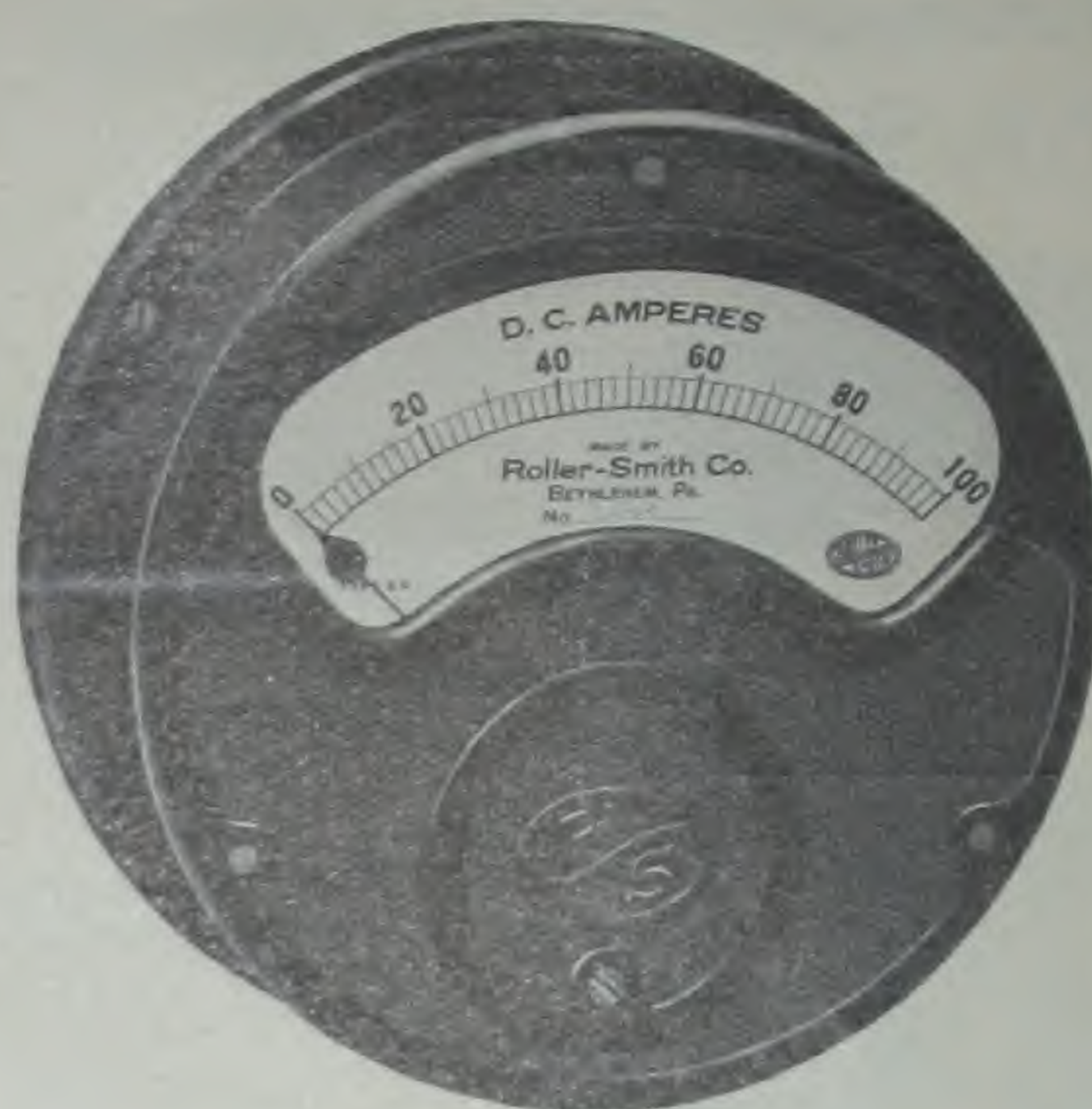
All instruments are accurate within $1\frac{1}{4}\%$ of full scale value.

Other details not common to all these instruments will be found in the section devoted to each particular type.

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS



Type SD

(7½" Diameter)

Ammeters and Voltmeters

Type SD instruments are recommended especially for medium size panels and other purposes where space is a consideration. The depth of Type SD ammeters and voltmeters is 3¾" and their scale length is 5". Average net weight per instrument is 8 pounds; shipping weight, 14 pounds. Complete dimensions are given on page 15.

AMMETERS

Cat. No.	Range in Amps.	Value Per Division	List Price
4320s	50 M. V. Capacity	Scale to suit shunt	\$28.00
4341	0- 1 Amp.	.02 Amp.	35.00
4327	0- 1.5 Amps.	.02 "	35.00
4328	0- 3 "	.05 "	35.00
4300	0- 5 "	.1 "	35.00
4301s	0- 10 "	.2 "	35.00
4302s	0- 15 "	.2 "	35.00
4303s	0- 25 "	.5 "	35.00
4304s	0- 50 "	1. "	35.00
4305s	0- 75 "	1. "	35.00
4306s	0-100 "	2. Amps.	35.00
4307s	0-150 "	2. "	35.00
4308s	0-200 "	5. "	35.00
*4309s	0-300 "	5. "	35.75
*4310s	0-400 "	10. "	36.00
*4311s	0-500 "	10. "	37.00
*4330	0-600 "	10. "	40.50
*4312s	0-750 "	10. "	43.25

* Separate 50 M. V. shunt with 6 ft. leads.

"s" indicates stock item.

VOLTMETERS

Cat. No.	Range in Volts	Value Per Division	List Price
4329s	0- 1.5 Volts	.02 Volt	\$36.00
4499s	0- 3 "	.05 "	36.00
4325s	0- 10 "	.2 "	37.50
4313s	0- 15 "	.2 "	37.50
4314s	0- 50 "	1. "	37.50
4332s	0- 75 "	1. "	37.50
4315s	0-100 "	2. Volts	38.00
4316s	0-150 "	2. "	39.50
4317s	0-300 "	5. "	48.00
4318s	0-600 "	10. "	51.00
4319s	0-750 "	10. "	54.00

DIFFERENTIAL VOLTMETERS

Differential Voltmeters can be supplied at a list price of \$10.00 additional to the list price of the left zero voltmeter of similar range. Differential voltmeters, being center zero instruments, the value per division is usually twice that of left zero voltmeters. Differential voltmeters have an extra terminal stud connected to the center of the moving coil winding.

Ammeters, ordinarily supplied as series devices (200 amperes and under) can be furnished as separate shunt instruments, at \$35.00 list each, including shunts and leads.

For ammeters with ranges higher than 750 amperes, add to the price of Cat. No. 4320 instrument the price of the appropriate shunt. See Page 14 for complete listing of shunts.

Milli-ammeters can be furnished in the following ranges: 0-5, 0-10, 0-15, 0-25, 0-50, 0-100, 0-250, 0-500 and 0-800 M. A. List price of any one of these ranges is \$35.00.

Center zero ammeters and milli-ammeters take the same list prices as left zero instruments. Scale divisions are about twice the value of left zero instruments.

Milli-voltmeters can be furnished in the following ranges: 0-50, 0-100, 0-250 and 0-500 M. V. List price of any one of these ranges is \$36.00.

Flush type cases can be furnished. Prices on application.

Front connected instruments can be furnished. Prices on application.

Extra pairs of ammeter leads, 6 feet long, per pair.....\$1.50 list.

For special length ammeter lead prices see Page 14.

Swinging brackets can be supplied when desired and details of these are given at bottom of Page 14.

In ordering specify quantity, catalog number and special features, if any.



Type RD
(Rectangular)

Ammeters and Voltmeters

Type RD instruments are offered to meet the ever increasing demand for rectangular instruments of conventional size and price and avoid the switchboard space waste encountered with round pattern instruments. Type RD instruments are 6" high, 5⁵/₈" wide and 3³/₄" deep. Scale length is 5³/₁₆". Average net weight per instrument is 8 pounds; shipping weight, 14 pounds. Complete dimensions are given on Page 15.

AMMETERS

Cat. No.	Range in Amps.	Values Per Division	List Price
43000	50 M. V. Capacity	Scale to suit shunt	\$28.00
43001	0- 1 Amp.	.02 Amp.	35.00
43002	0- 1.5 Amps.	.02 "	35.00
43003	0- 3 "	.05 "	35.00
43004	0- 5 "	.1 "	35.00
43005	0- 10 "	.2 "	35.00
43006	0- 15 "	.2 "	35.00
43007	0- 25 "	.5 "	35.00
43008	0- 50 "	1. "	35.00
43009	0- 75 "	1. "	35.00
43010	0-100 "	2. Amps.	35.00
43011	0-150 "	2. "	35.00
43012	0-200 "	5. "	35.00
*43013	0-300 "	5. "	35.75
*43014	0-400 "	10. "	36.00
*43015	0-500 "	10. "	37.00
*43028	0-600 "	10. "	40.50
*43016	0-750 "	10. "	43.25

*Separate 50 M. V. shunt with 6 ft. leads.

VOLTMETERS

Cat. No.	Range in Volts	Values Per Division	List Price
43017	0- 1.5 Volts	.02 Volt	\$36.00
43018	0- 3 "	.05 "	36.00
43019	0- 10 "	.2 "	37.50
43020	0- 15 "	.2 "	37.50
43021	0- 50 "	1. "	37.50
43022	0- 75 "	1. "	37.50
43023	0-100 "	2. Volts	38.00
43024	0-150 "	2. "	39.50
43025	0-300 "	5. "	48.00
43026	0-600 "	10. "	51.00
43027	0-750 "	10. "	54.00

DIFFERENTIAL VOLTMETERS

Differential Voltmeters can be supplied at a list price of \$11.00 additional to the list price of the left zero voltmeter of similar range. Differential voltmeters, being center zero instruments, the value per division is usually twice that of left zero voltmeters. Differential voltmeters have an extra terminal stud connected to the center of the moving coil winding.

Ammeters, ordinarily supplied as series devices (200 amperes and under), can be furnished as separate shunt instruments, at \$35.00 list each, including shunts and leads.

For ammeters with ranges higher than 750 amperes, add to the price of Cat. No. 43000 instrument the price of the appropriate shunt. See page 14 for complete listing of shunts.

Milli-ammeters can be furnished in the following ranges: 0-5, 0-10, 0-15, 0-25, 0-50, 0-100, 0-250, 0-500 and 0-800 M. A. List price of any one of these ranges is \$35.00.

Center zero ammeters and milli-ammeters take the same list prices as left zero instruments. Scale divisions are about twice the value of left zero instruments.

Milli-voltmeters can be furnished in the following ranges: 0-50, 0-100, 0-250 and 0-500 M. V. List price of any one of these ranges is \$36.00.

Extra pairs of ammeter leads, 6 feet long, per pair.....\$1.50 list
For special length ammeter lead prices see page 14.

Swinging brackets can be supplied when desired and details of these are given at bottom of page 14.

In ordering specify quantity, catalog number and special features, if any.

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS



Type ND

(9 $\frac{1}{16}$ " Diameter)

Ammeters and Voltmeters

Type ND instruments are designed for large switchboards and for other applications where a long scale, round pattern instrument is needed. The depth of Type ND ammeters and voltmeters is 3 $\frac{3}{4}$ " and their scale length is 6 $\frac{1}{4}$ ". Average net weight per instrument is 12 pounds; shipping weight, 18 pounds. Complete dimensions are given on Page 15.

AMMETERS

Cat. No.	Range in Amps.	Value Per Division	List Price
4371a	50 M. V. Capacity	Scale to suit shunt	\$46.25
4321	0-1 Amp.	.02 Amp.	53.25
4322	0-1.5 Amps.	.02 "	53.25
4323	0-3 "	.05 "	53.25
4324	0-5 "	.1 "	53.25
4351	0-10 "	2 "	53.25
4352	0-15 "	3 "	53.25
4353	0-25 "	5 "	53.25
4354	0-50 "	1. "	53.25
4355	0-75 "	1.5 "	53.25
4356	0-100 "	2. Amps.	53.25
4357	0-150 "	2.5 "	53.25
4358	0-200 "	3 "	53.25
4359	0-250 "	5 "	54.00
4360	0-300 "	10. "	54.25
4361	0-500 "	10. "	56.50
4362	0-750 "	10. "	58.75
4363	0-1000 "	10. "	61.50
4364	0-1500 "	20. "	63.75
4365	0-2000 "	20. "	66.00
4366	0-2500 "	20. "	79.00
4367	0-3000 "	20. "	88.75
4368	0-4000 "	50. "	97.75

* Separate 50 M. V. shunt with 6 ft. leads.

"a" indicates stock item.

Ammeters ordinarily supplied as series devices (200 amperes and under) can be furnished as separate shunt instruments at \$53.25 list, including shunt and leads.

For ammeters with ranges over 3000 amperes add to the price of Cat. No. 4374 instrument the price of the appropriate shunt. See Page 14 for complete listing of shunts.

Milli-ammeters can be furnished in the following ranges: 0-5, 0-10, 0-25, 0-50, 0-100, 0-250, 0-500 and 0-800 M. A. List price of any one of these ranges is \$53.25.

Center zero ammeters and milli-ammeters take the same list prices as left zero instruments. Scale divisions are about twice the value of left zero instruments.

Milli-voltmeters can be furnished in the following ranges: 0-50, 0-100, 0-250 and 0-500 M. V. List price of any one of these ranges is \$53.25.

Flush type cases can be furnished. Prices on application.

Front connected instruments can be furnished. Prices on application.

Extra pairs of ammeter leads, 6 feet long, per pair.....\$1.50 list.

For special length ammeter lead prices see Page 14.

Swinging brackets can be supplied when desired and details of these are given at bottom of Page 14.

In ordering, specify quantity, catalog number and special features, if any.

VOLTMETERS

Cat. No.	Range in Volts	Value Per Division	List Price
4326a	0-1.5 Volts	.02 Volt	\$53.25
4327a	0-3 "	.05 "	53.25
4328a	0-10 "	.2 "	53.25
4367a	0-15 "	.2 "	53.25
4368a	0-50 "	1. "	56.25
4388a	0-75 "	1. "	58.00
4369a	0-100 "	2. Volts	58.00
4370a	0-150 "	2. "	63.00
4371a	0-300 "	5. "	69.00
4372a	0-600 "	10. "	74.25
4373a	0-750 "	10. "	77.00

DIFFERENTIAL VOLTMETERS

Differential Voltmeters can be supplied at a list price of \$15.00 additional to the list price of the left zero voltmeter of similar range. Differential voltmeters, being center zero instruments, the value per division is usually twice that of left zero voltmeters. Differential voltmeters have an extra terminal stud connected to the center of the moving coil winding.

Type HED

(9½" overall width)

Ammeters and Voltmeters



This is our Horizontal Edgewise model which is used when it is desired to utilize a minimum of switchboard space for the instruments without sacrificing scale length, and also when a large number of voltmeters and ammeters must be used on the same panel to control many main or branch circuits.

The overall width is 9½", the overall height 5½" and the depth 7¼". Scale length is 7⅞". Average net weight per instrument is 17 pounds; shipping weight, 24 pounds. Complete dimensions are given on Page 15.

AMMETERS				VOLTMETERS			
Cat. No.	Range in Amps.	Value Per Division	List Price	Cat. No.	Range in Volts	Value Per Division	List Price
4424s	50 M. V. Capacity	Scale to suit shunt	\$56.00	4438s	0- 1.5 Volts	.02 Volt	\$58.00
4426	0- 1 Amp.	.02 Amp.	56.00	4448s	0- 3 "	.05 "	58.00
4472	0- 1.5 Amps.	.02 "	56.00	4439s	0- 10 "	.2 "	58.00
4473	0- 3 "	.05 "	56.00	4417s	0- 15 "	.2 "	58.00
4400	0- 5 "	.1 "	56.00	4418s	0- 50 "	1. "	64.00
4401	0- 10 "	.2 "	56.00	4425s	0- 75 "	1. "	64.00
4402	0- 15 "	.2 "	58.00	4419s	0-100 "	2. Volts	64.00
4403	0- 25 "	.5 "	58.00	4420s	0-150 "	2. "	64.00
4404	0- 50 "	1. "	58.00	4421s	0-300 "	5. "	70.00
4405	0- 75 "	1. "	59.00	4422s	0-600 "	10. "	78.00
4406	0- 100 "	2. Amps.	60.00	4423s	0-750 "	10. "	82.00
4407	0- 150 "	2. "	61.00	DIFFERENTIAL VOLTMETERS Differential Voltmeters can be supplied at a list price of \$17.50 additional to the list price of the left zero voltmeter of similar range. Differential voltmeters, being center zero instruments, the value per division is usually twice that of left zero voltmeters. Differential voltmeters have an extra terminal stud connected to the center of the moving coil winding.			
4408	0- 200 "	5. "	62.00				
*4409	0- 300 "	5. "	65.00				
*4410	0- 400 "	10. "	68.00				
*4411	0- 500 "	10. "	68.00				
*4430	0- 600 "	10. "	70.00				
*4412	0- 750 "	10. "	73.00				
*4413	0-1000 "	20. "	75.00				
*4498	0-1200 "	20. "	75.00				
*4414	0-1500 "	20. "	83.00				
*4415	0-2000 "	50. "	90.00				
*4416	0-3000 "	50. "	101.00				

* Separate 50 M. V. shunt with 6 ft. leads.

"s" indicates stock item.

Ammeters ordinarily supplied as series devices (200 amperes and under) can be furnished as separate shunt instruments at \$66.00 list, including shunt and leads.

For ammeters with ranges above 3000 amperes, add to the price of Cat. No. 4424 instrument the price of the appropriate shunt. See Page 14 for complete listing of shunts.

Milli-ammeters can be furnished in the following ranges: 0-5, 0-10, 0-15, 0-25, 0-50, 0-100, 0-250, 0-500 and 0-800 M.A. List price of any of these ranges is \$56.00.

Center zero ammeters and milli-ammeters take the same list prices as left zero instruments. Scale divisions are about twice the value of left zero instruments.

Milli-voltmeters can be furnished in the following ranges: 0-50, 0-100, 0-250 and 0-500 M. V. List price of any one of these ranges is \$56.00.

Only surface mounting, back connected instruments are available in Type HED.

Extra pairs of ammeter leads, 6 feet long, per pair.....\$2.00 list.

For special length ammeter lead prices see Page 14.

Swinging brackets can be supplied when desired and details of these are given at bottom of Page 14.

In ordering specify quantity and catalog number and special features, if any.



Type IDD (Illuminated Dial)

TYPE IDD

Type IDD, largely used in central stations, has a translucent porcelain dial, back of which is mounted an Edison base for an incandescent lamp so that the scale may be read from a considerable distance.

Overall width is $13\frac{3}{4}$ ", overall height $11\frac{1}{8}$ " and depth $4\frac{1}{2}$ ". Scale length is 10". Dial is porcelain with scale and figures painted in black thereon. Lamp connections are at top of case, near lamp receptacle. Average net weight per instrument is 18 pounds; shipping weight, 30 pounds.

*AMMETERS

Cat. No.	Range in Amps.	Value Per Division	List Price
4450	0-100 Amps.	1. Amp.	\$150.00
4451	0-150 "	1. "	150.00
4452	0-200 "	2. Amps.	150.00
4453	0-300 "	2.5 "	150.75
4454	0-400 "	5. "	151.00
4455	0-500 "	5. "	153.25
4456	0-600 "	5. "	155.50
4457	0-750 "	5. "	158.25
4458	0-1000 "	10. "	160.50
4459	0-1200 "	10. "	162.75
4460	0-1600 "	10. "	175.75
4461	0-2000 "	20. "	185.50
4462	0-3000 "	25. "	194.50
4463	0-4000 "	50. "	211.50
4464	0-5000 "	50. "	245.50
4465	0-7500 "	50. "	303.00

VOLTMETERS

Cat. No.	Range in Volts	Value Per Division	List Price
4464	0-15 Volts	.1 Volt	\$140.00
4465	0-50 "	.5 "	140.00
4466	0-100 "	1. "	140.00
4467	0-150 "	1. "	142.50
4468	0-300 "	2.5 Volts	148.00
4469	0-600 "	5. "	150.00
4470	0-750 "	5. "	152.00

DIFFERENTIAL VOLTMETERS

4440	15-0-15 Volts	.5 Volt	\$159.00
4441	50-0-50 "	2. Volts	159.00
4442	100-0-100 "	5. "	159.00
4443	150-0-150 "	5. "	161.00
4444	300-0-300 "	10. "	166.50
4445	600-0-600 "	20. "	178.00
4446	750-0-750 "	25. "	180.00

* All ammeters have separate 50 M. V. shunts with 6 ft. leads.

† External resistor.

Center zero ammeters take the same list prices as left zero instruments. Scale divisions are about twice the value of left zero instruments.

Differential Voltmeters have an extra terminal stud connected to the middle of the moving coil winding.

Extra pair of leads, 6 feet long, per pair, \$1.50 list extra.

For special length ammeter lead length prices, see below. For swinging brackets, see page 39.

In ordering specify quantity, catalog number and special features, if any.

Direct Current Switchboard Instrument SHUNTS (50 M. V. Drop)

Cat. No.	Ampere Capacity	List Price	Cat. No.	Ampere Capacity	List Price	Cat. No.	Ampere Capacity	List Price
4481	1	7.00	4481a	100	7.00	4488	1000	17.50
4482	1.5	7.00	4482a	150	7.00	4495a	1200	19.75
4483	2	7.00	4483a	200	7.00	4489a	1500	32.75
4475a	5	7.00	4484a	300	7.75	4490a	2000	42.50
4476a	10	7.00				4471a	2500	46.25
4477a	15	7.00	4485a	400	8.00	4491a	3000	51.50
4478a	25	7.00	4486a	500	10.25	4492	4000	68.50
4479a	30	7.00	4487a	600	12.50	4493a	5000	102.50
4480a	75	7.00	4487	750	15.25	4494	7500	160.00

"a" indicates stock item.

Prices on shunts over 7500 amperes furnished on application.

See page 16 for dimensions of shunts.

EXTERNAL MULTIPLIERS

Prices on these quoted on application.

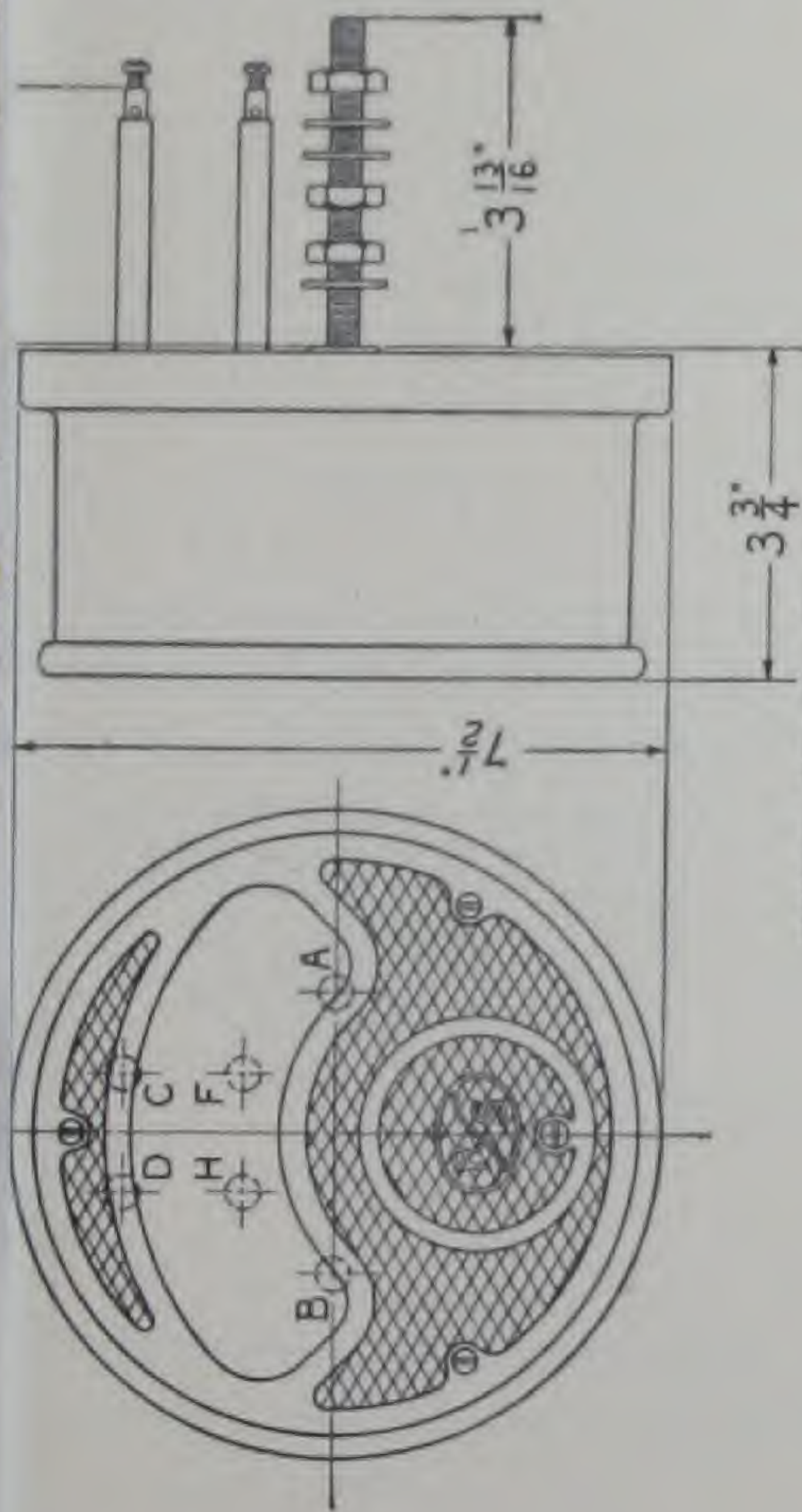
AMMETER LEADS

Length	List Price	Examples:
5-25 ft. Incl.	\$1.50	7 ft. Leads 7x.37 = \$2.59
11-12 "	.37 per ft.	11 ft. Leads 11x.46 = 5.06
16-25 "	.46 "	16 ft. Leads 16x.55 = 8.80
	.55 "	

Prices on leads longer than 25 feet on application.

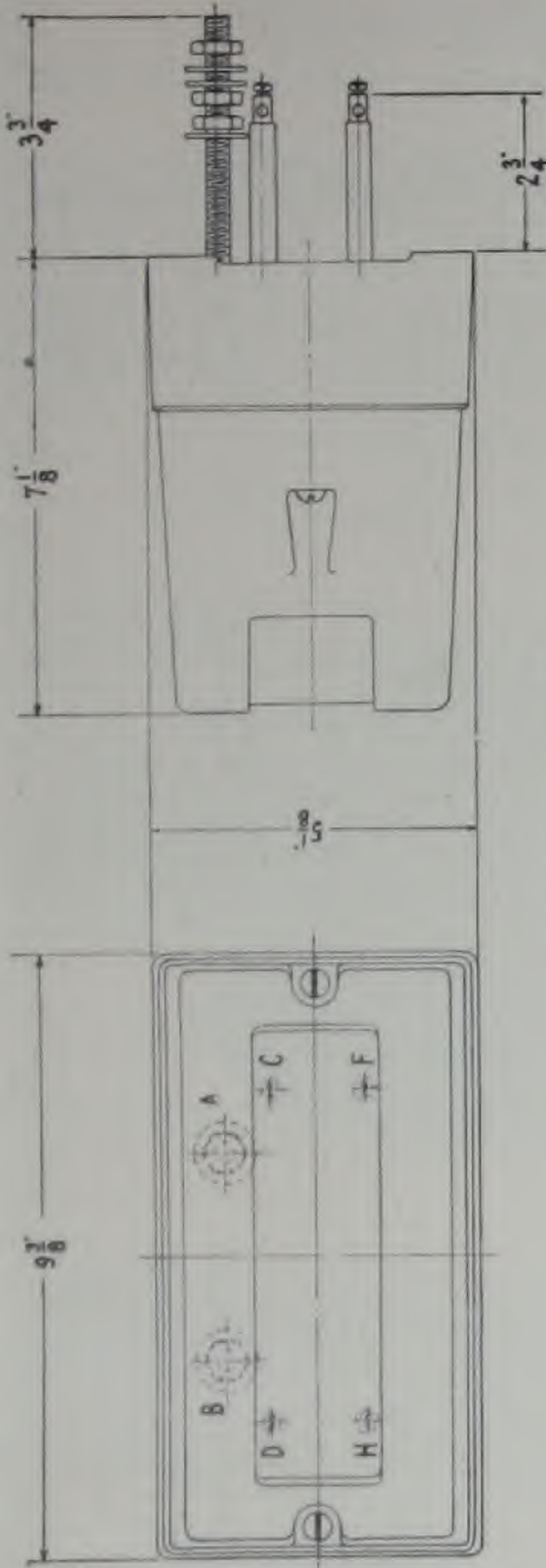
SWINGING BRACKETS

For prices on swinging brackets for switchboard type instruments, see page 39.



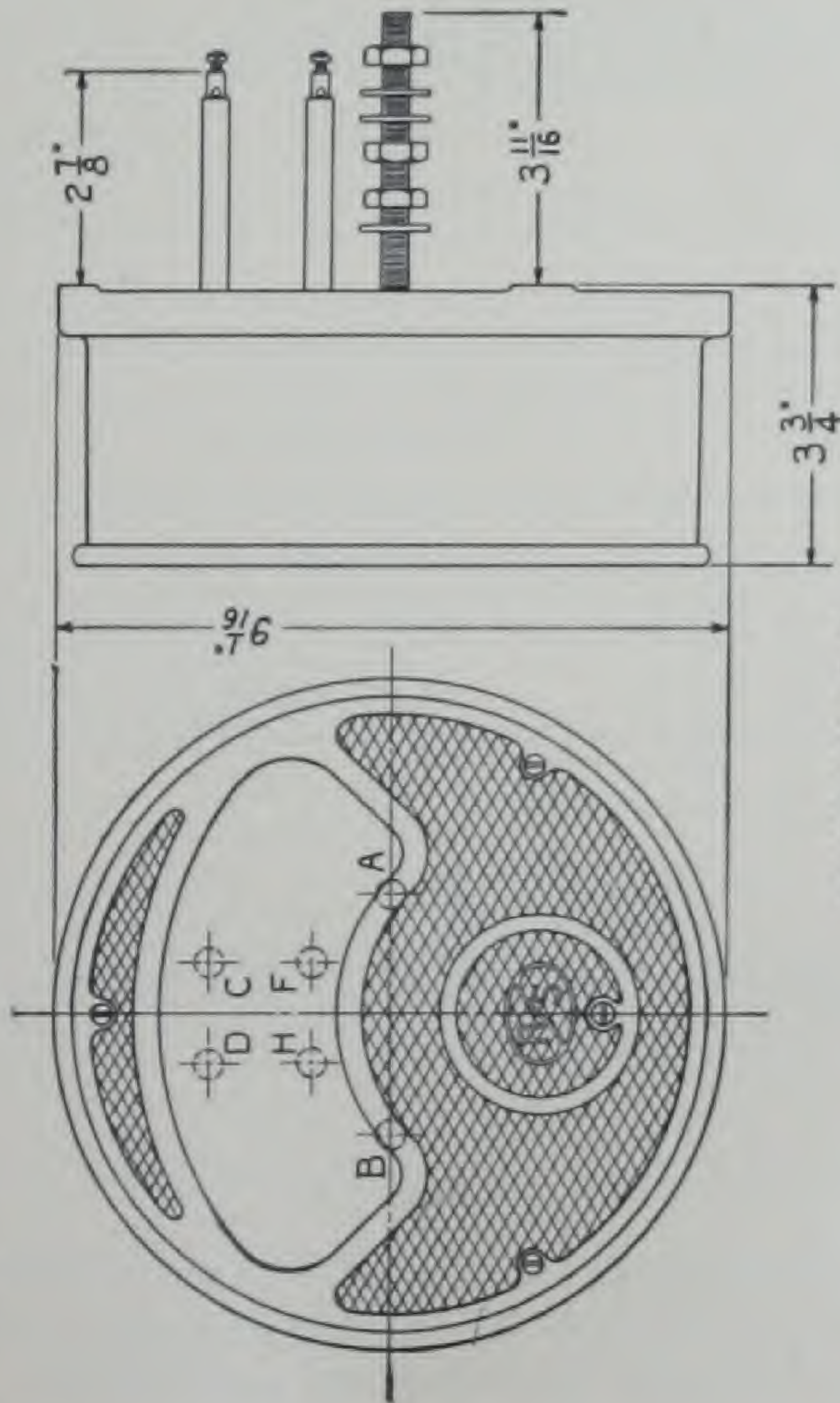
TYPE SD D. C.
AMMETER OR VOLTmeter

Net Weight, 8 Lbs.
Shipping Weight, 14 Lbs.
Ammeter, Voltmeter—Studs A, B. Other studs for A. C. instruments only.



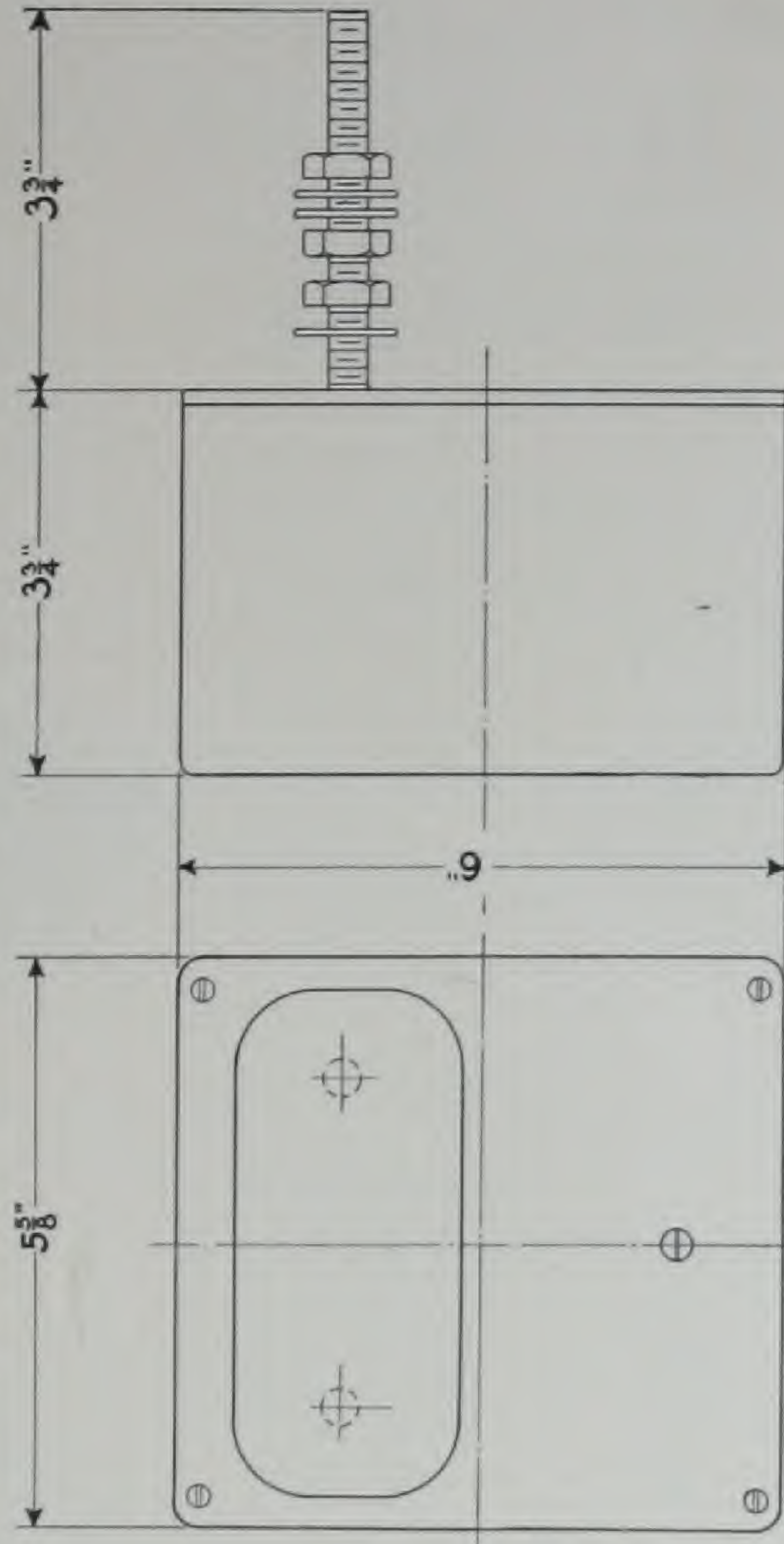
TYPE HED D. C.
AMMETER OR VOLTmeter

Net Weight, 15 Lbs.
Shipping Weight, 24 Lbs.
Ammeter, Voltmeter—Studs A, B. Other studs for A. C. instruments only.



TYPE ND D. C.
AMMETER OR VOLTmeter

Net Weight, 12 Lbs.
Shipping Weight, 19 Lbs.
Ammeter, Voltmeter—Studs A, B. Other studs for A. C. instruments only.



TYPE RD
AMMETER OR VOLTmeter

Net Weight, 8 Lbs.
Shipping Weight, 14 Lbs.

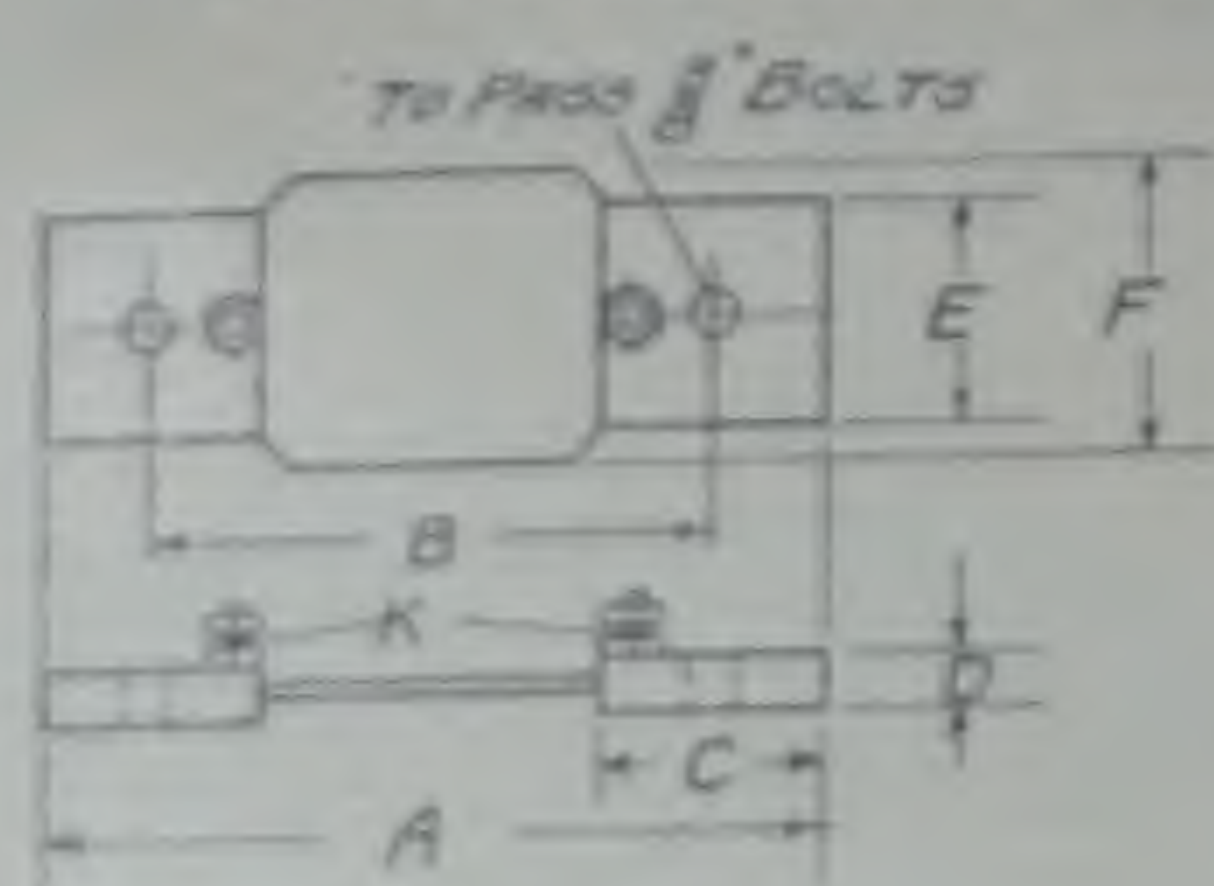
ALL DIMENSIONS ARE APPROXIMATE AND FOR REFERENCE PURPOSES ONLY.

RELAYS

CIRCUIT
BREAKERS

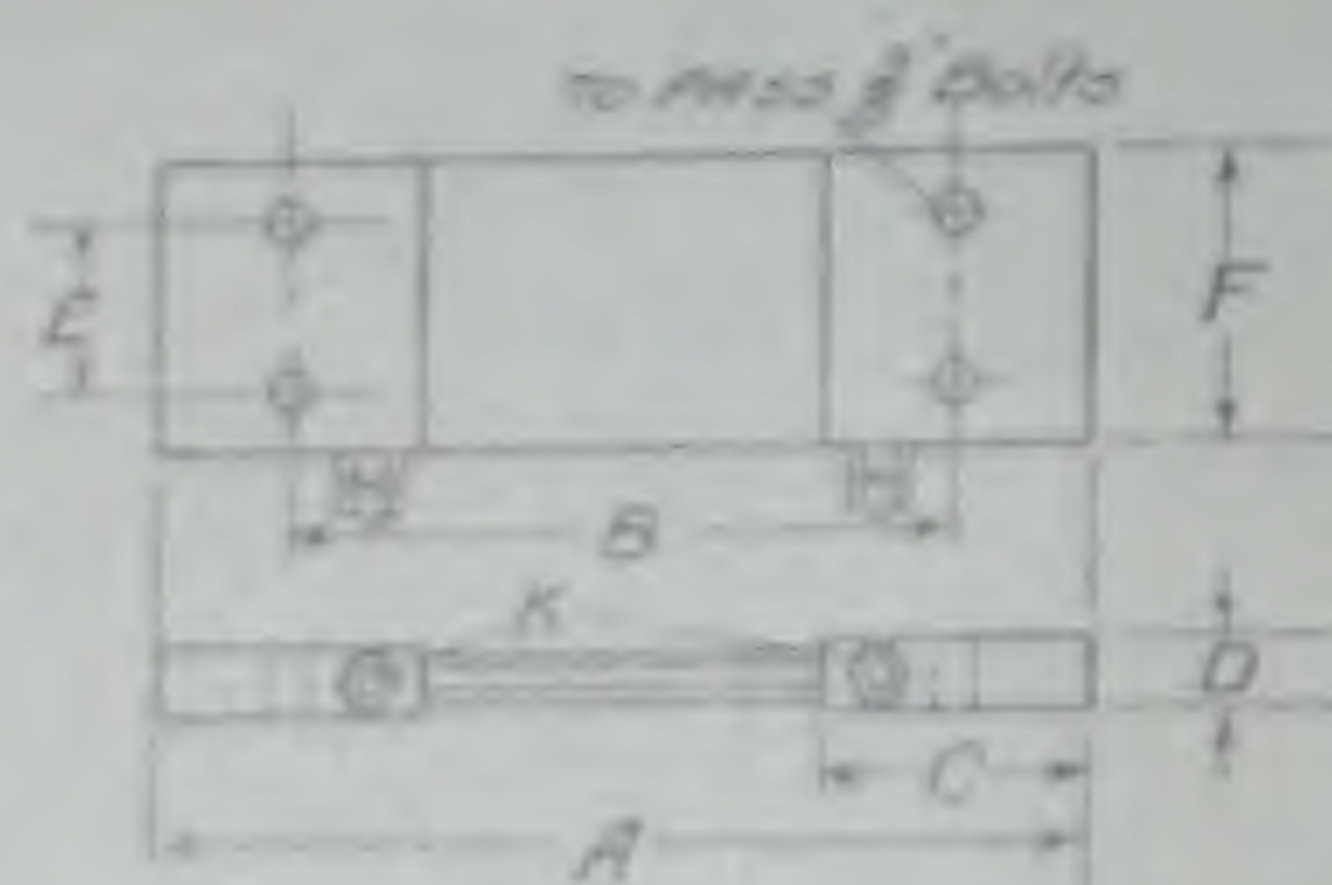
PORTABLE
INSTRUMENTS

*D. C. SWITCHBOARD 50 M. V. AMMETER SHUNTS



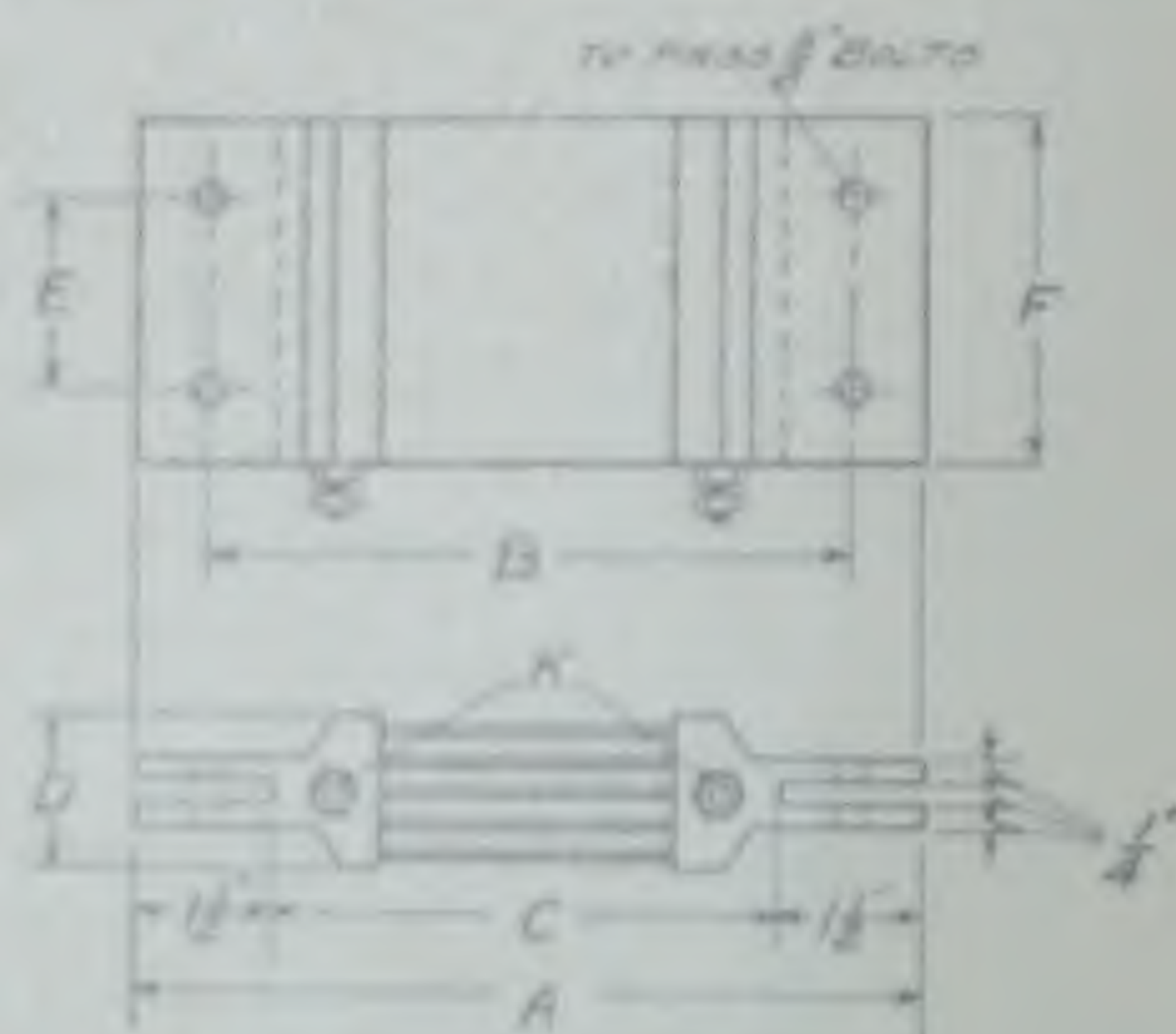
AMPS	A	B	C	D	E	F	NET WEIGHT	SHIP WEIGHT
100	5 1/2"	4 1/2"	1 3/4"	1/2"	1 1/2"	1 1/2"	1/2 lb.	1 1/2 lbs.
150	5 1/2"	4 1/2"	1 3/4"	1/2"	1 1/2"	1 3/4"	1/2 lb.	1 1/2 lbs.
200	6"	4 1/2"	2"	3/8"	1 1/2"	1 1/4"	3/4 lb.	1 3/4 lbs.

K=INST. LEAD TERMINALS



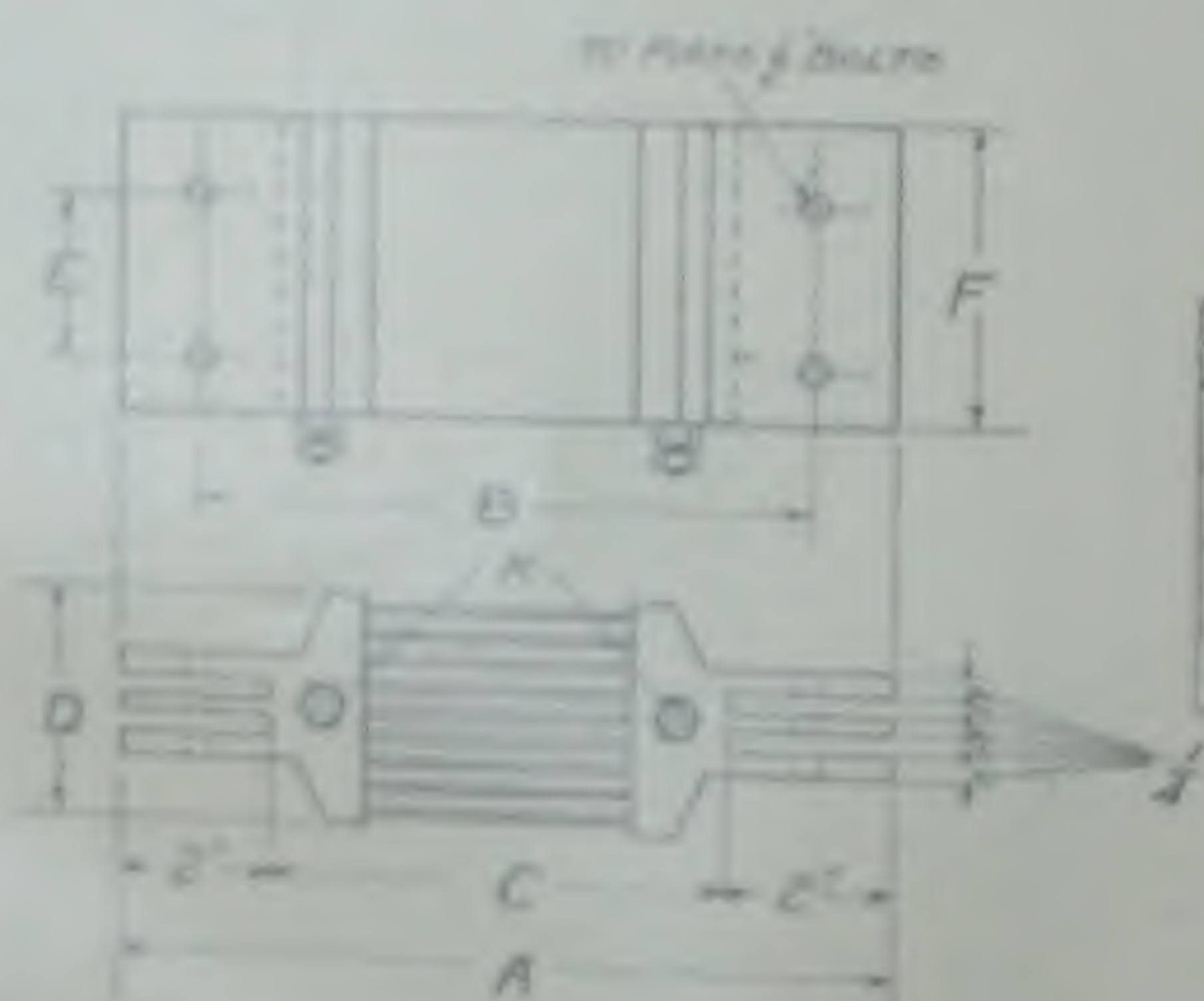
AMPS	A	B	C	D	E	F	NET WEIGHT	SHIP WEIGHT
300	6"	4"	2"	3/8"	1"	2"	1 lb.	2 lbs.
400	7"	4 1/2"	2 1/2"	3/8"	1 1/2"	2 1/2"	1 3/4 lbs.	2 3/4 lbs.
500	7"	4 1/2"	2 1/2"	1/2"	1 1/2"	2 1/2"	2 lbs.	3 lbs.
600	7"	4 1/2"	2 1/2"	1/2"	1 1/2"	2 3/4"	2 1/2 lbs.	3 1/2 lbs.
750	8"	5"	3"	1/2"	1 1/2"	3"	3 1/4 lbs.	9 1/4 lbs.
800	8"	5"	3"	1/2"	1 1/2"	3"	3 1/4 lbs.	9 1/4 lbs.

K=INST. LEAD TERMINALS



AMPS	A	B	C	D	E	F	NET WEIGHT	SHIP WEIGHT
1000	7"	5 1/2"	4"	1"	1 1/2"	2 1/2"	3 1/2 lbs.	9 1/2 lbs.
1500	8"	6 1/2"	5"	1 1/2"	1 1/2"	3"	6 lbs.	12 lbs.
2000	8"	6 1/2"	5"	1 1/2"	1 1/2"	3"	6 1/2 lbs.	12 lbs.

K=INST. LEAD TERMINALS



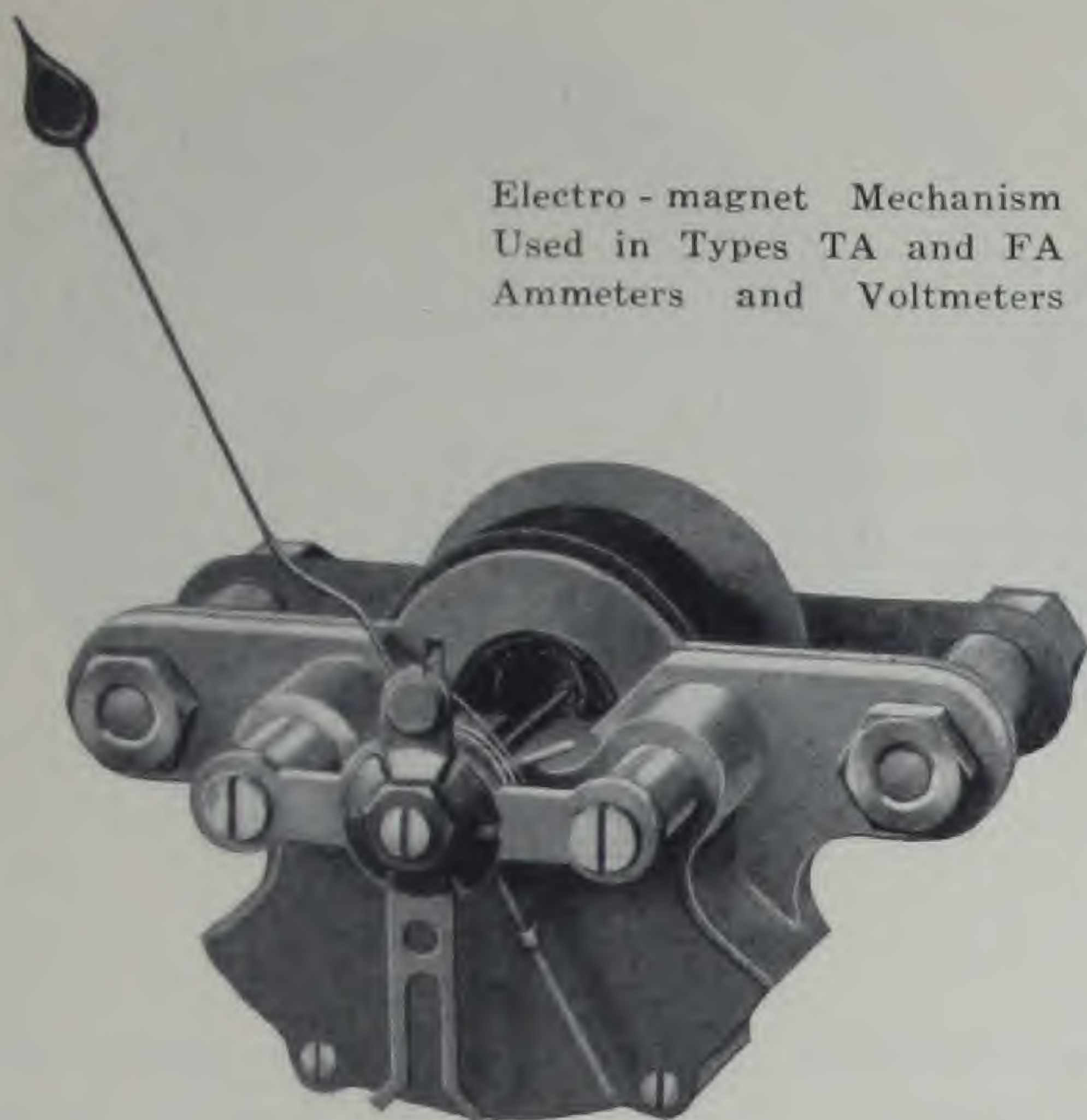
AMPS	A	B	C	D	E	F	NET WEIGHT	SHIP WEIGHT
2500	9 1/2"	7 1/2"	5 1/2"	1 1/2"	2"	4"	11 1/2 lbs.	17 1/2 lbs.
3000	9 1/2"	7 1/2"	5 1/2"	1 1/2"	2"	4"	11 1/2 lbs.	17 1/2 lbs.
4000	9 1/2"	7 1/2"	5 1/2"	2 1/2"	2"	4"	13 3/4 lbs.	20 lbs.
5000	10 1/2"	8 1/2"	5 1/2"	2 1/2"	2"	4"	16 lbs.	25 lbs.

K=INST. LEAD TERMINALS

*All Dimensions Are VERY Approximate and for Reference Purposes Only. Important changes in shunt dimensions will be made in the near future. Certified dimensions furnished on application.

Alternating Current Switchboard Instruments

Type TA (3½") and Type FA (4")



Electro - magnet Mechanism
Used in Types TA and FA
Ammeters and Voltmeters

Reference to the illustrations will show the pleasing appearance of these instruments, and the open, well lighted and extremely long scales.

TYPE TA

For surface mounted instruments the Type TA case is made of molded bakelite. The advantages of this material for an instrument case are many. Permanent finish, highest insulating qualities and freedom from corrosion are a few of the superior qualities that a bakelite case possesses. TA instruments usually have metal bases, but bakelite bases are sometimes used. Bakelite bases will always be supplied if specified. Surface mounted metal cases, either with or without base flange as may be specified, can be furnished on special order without extra charge when called for. Flush metal or bakelite cases can be supplied without extra charge when specified.

Type TA voltmeters have self-contained resistances up to and including 50 volts. For 75, 100, 150 and 300 volt instruments an external resistor in the form of a flat disc (see page 21) is supplied, such discs being supported by the studs of the instrument. For ranges over 300 volts larger forms of resistors are used, which are built in cylindrical containers, which can be secured to the switchboard or panel by appropriate screws.

TYPE FA

Type FA instruments are supplied in the surface type only and cases are of metal with our well known black rubberoid finish. Bases are of metal, strong and rigid.

Front connected Type FA instruments can be supplied on special order at an extra charge. Correspondence regarding such is invited.

Type FA voltmeters up to 150 volts and Type FA Wattmeters up to 150 volts have self-contained resistors and above that separately mounted resistors are used. These resistors are of the cylindrical type.

GENERAL

All instruments are dust and moisture proof. When we are advised that instruments are to be used under damp or tropical conditions special precautions are taken to adapt the instruments to those conditions.

Connections are in the form of rear studs so arranged that they cannot turn and a full complement of nuts and washers is supplied. In mounting a surface instrument it is necessary to drill only the holes for the studs which studs are provided with holding nuts to secure the instrument firmly in place. A flush type instrument is held in place by means of screws in the mounting holes in the rim.

The instruments are exceptionally well damped by means of a light but rigid aluminum air vane rotating in a die cast chamber.

Dials are of pure white bristol-board of the highest grade. Non-fading black India ink, which retains its legibility indefinitely, is used in all types. Dials with special markings will be supplied on quantity propositions without extra charge.

Glasses are free from flaws and are firmly fastened in place.

Springs are of phosphor-bronze, well aged to minimize zero shifting.

Mechanisms are mounted on the bases in such a manner that strains and stresses on either the base or the case are not transmitted to the moving element.

All Type FA instruments are regularly equipped with zero adjusters and Type TA instruments will be so equipped without extra charge on special order.

Mechanisms of the ammeters and voltmeters are of the electro-magnet type and of the wattmeters of the electro-dynamometer type. See above for illustration of electro-magnet mechanism. On both Types TA and FA ammeters and voltmeters the readable portion of the scale is from about 20% of scale to full scale. Scale divisions of FA wattmeters are uniform and readings can be taken throughout the entire range.

All instruments (with the exception of the 10 and 15 volt voltmeters) are accurate within 1½% of full scale value at any point on the readable portion of the scale. The 10 and 15 volt voltmeters are slightly less accurate. On special order and without extra charge any instrument will be calibrated with highest possible accuracy at any particular point.

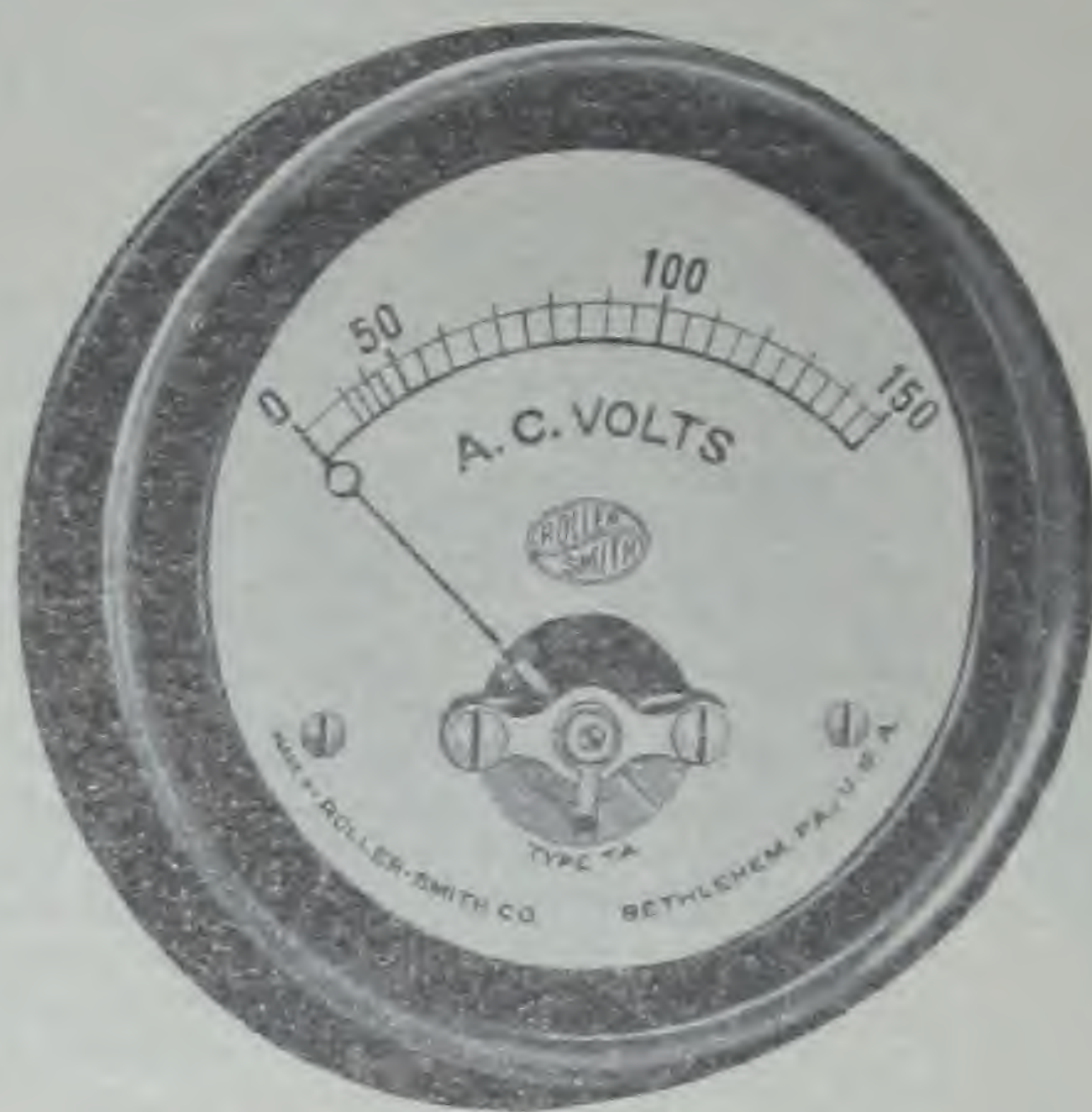
All instruments are accurate on all frequencies up to and including 133 cycles.

Other details not common to all these instruments will be found in the section devoted to each particular type.

Type TA

(3½" Diameter)

Ammeters and Voltmeters



Surface Model



Flush Model

Type TA instruments are recommended for all applications where an instrument of very small size is desired. Diameter overall is 3½", body diameter 2⅝" (2¾" for flush bakelite case) and depth (not including studs) is 1⅝" for the surface model and 1¼" (behind the flange) for the flush model. Net weight is 12 ounces, shipping weight 1 pound. See page 21 for detailed dimensions. Scale is 2" long.

MILLI-AMMETERS

Cat. No.	Range	Value Per Scale Division	List Price
4201	0-50 M.A.	2.0 M.A.	10.25
4200s	0-100	5.0	10.25
4247	0-150	5.0	10.25
4249s	0-200	5.0	10.25
4251	0-300	10.0	10.25
4253	0-400	10.0	10.25
4204	0-500	20.0	10.25
4237	0-800	20.0	10.25

AMMETERS

Cat. No.	Range	Value Per Scale Division	List Price
4206s	0-1 Amp.	.025 Amp.	\$10.25
4263	0-1.5	.05	10.25
4208s	0-3	.1	10.25
4210s	0-5	.2	10.25
4212	0-10	.25	10.25
4214s	0-15	.5	10.25
4279	0-20	.5	10.25
4216s	0-30	1.0	13.00
4259	0-40	1.0	13.00
4218s	0-50	2.0	13.00

†VOLTMETERS

Cat. No.	Range in Volts	Value Per Scale Division	List Price
4217s	0-10 Volts	.5 Volt	\$10.25
4219s	0-15	.5	10.25
4261	0-20	.5	10.25
4220s	0-30	1.0	10.25
4222s	0-50	2.0	10.25
Cat. No.	Range in Volts	Value Per Scale Division	List Price
*4223	0-75 Volts	2.5 Volt	\$10.25
*4221	0-100	2.5	12.75
*4226s	0-150	5.0	13.00
*4205s	0-300	10.0	15.50

*Has external resistor.

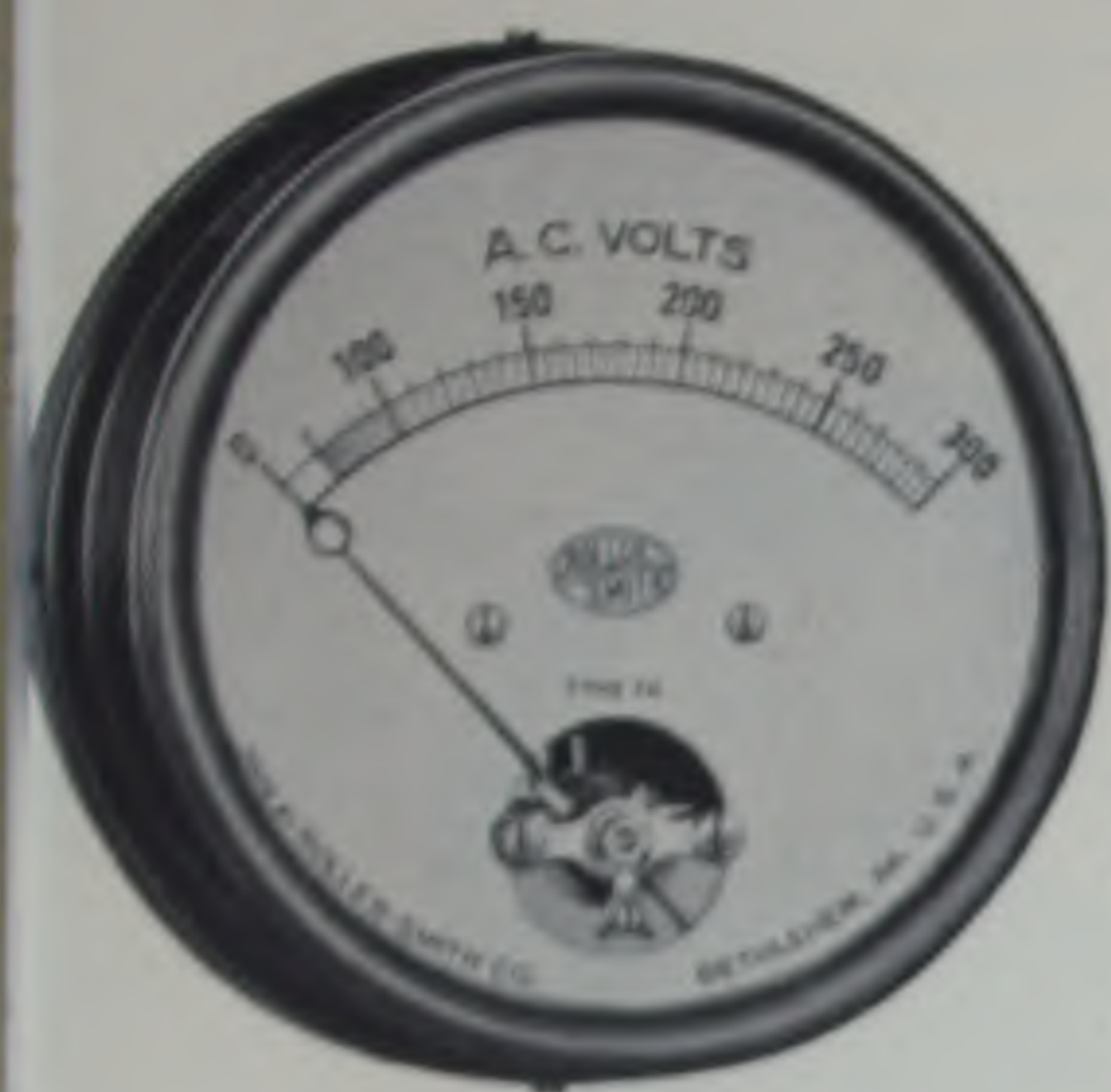
"s" indicates stock item.

†Volts in ranges down to 1 volt and in ranges 75 volts and higher, self-contained, can be supplied with higher resistance than the standard type TA voltmeters. Details and prices on application.

DIRECTIONS FOR ORDERING: Specify quantity, catalog number and whether flush or surface model. Surface model furnished unless otherwise specified.

Type FA (4" Diameter)

Ammeters and Voltmeters



The Type FA instruments are especially adapted to applications where one desires an instrument larger than the Type TA but not as large as the conventional 7½" size. Diameter overall is 4" and depth (not including studs) is 1¼". Average net weight is 20 ounces and shipping weight 1½ pounds. See page 21 for detailed dimensions. Scale is 2¾" long.

All Type FA instruments are equipped with zero adjusters.

MILLI-AMMETERS

Cat. No.	Range	Value Per Scale Division	List Price
209	0-50 M.A.	1.0 M.A.	\$14.50
228	0-100	2.0	14.50
208	0-150	2.5	14.50
296	0-200	3.0	14.50
297	0-300	3.0	14.50
238	0-400	10.0	14.50
232	0-500	10.0	14.50
245	0-600	20.0	14.50

AMMETERS

Cat. No.	Range	Value Per Scale Division	List Price
4234	0-1 Amp.	.02 Amp.	14.50
4235	0-1.5 Amper.	.025	14.50
4236a	0-3	.03	14.50
4236a	0-5	.1	14.50
4240a	0-10	.2	14.50
4242a	0-15	.25	14.50
4281	0-20	.5	14.50
4244a	0-30	.3	14.50
4212	0-40	1.0	14.50
4246a	0-50	1.0	14.50
4283	0-60	1.0	19.00
4285	0-80	2.0	19.00
4287	0-100	2.0	21.00
4290	0-150	3.0	24.00
4291	0-200	3.0	24.00

VOLTMETERS

Cat. No.	Range in Volts	Value Per Scale Division	List Price
4227	0-10 Volts	.2 Volt	\$20.00
4263	0-15	.25	20.00
4299	0-20	.5	20.00
4248	0-30	.5	20.00
4250a	0-50	1.0	20.00
Cat. No.	Range in Volts	Value Per Scale Division	List Price
4225	0-75 Volts	1.0 Volt	\$20.00
4267	0-100	2.0	20.00
4256a	0-150	2.5	20.00
*4260a	0-300	3.0	20.00

*Has external resistor.

"a" indicates stock item.

DIRECTIONS FOR ORDERING: Specify quantity and catalog number.

Front connected instruments can be supplied on special order and at an extra charge. Details on request.

Type FA

(4" Diameter)

D. C. and A. C. Single Phase Wattmeters



Type FA wattmeters are offered to meet the demand for a medium size instrument which takes a reasonably small amount of space on a panel and still affords close readings on the scale. Diameter overall is 4" and depth (not including studs) is 2½". Average net weight is 2½ pounds and shipping weight is 5 pounds. See page 21 for detailed dimensions. Scale is 2½" long.

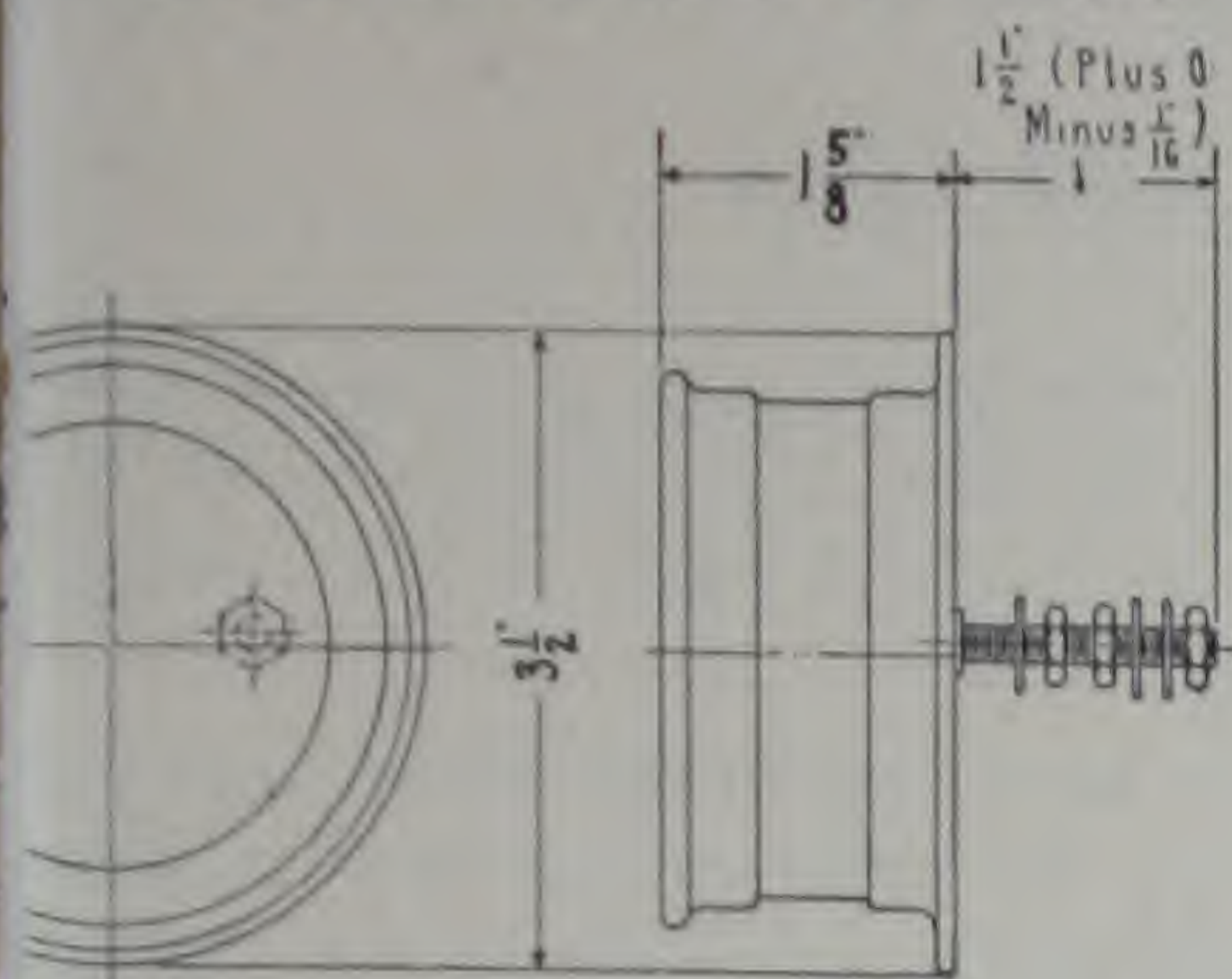
All Type FA wattmeters are equipped with zero adjusters.

D. C. AND A. C. SINGLE PHASE WATTMETERS

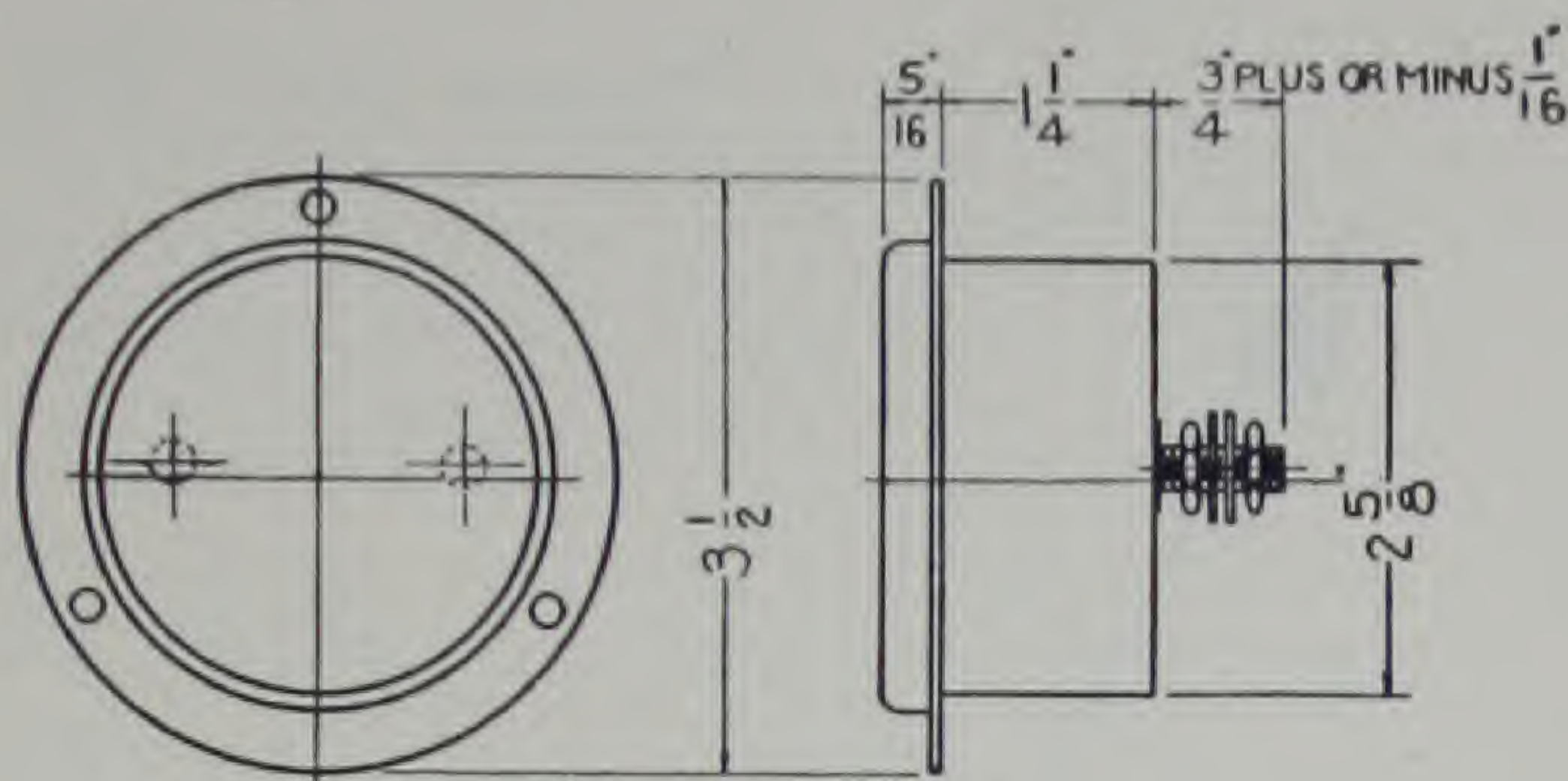
Cat. No.	Amps.	Volts	Scale Range	Value per Scale Division	List Price
4264	3	100-120	0-75 Watts	1.0 Watt	\$55.00
4265	3	200-250	0-150	2.0	60.00
4270	1	100-150	0-150	2.0	55.00
4272	1	200-250	0-300	5.0	60.00
4275	3	100-150	0-750	10.0	55.00
4278	3	200-250	0-150 K. W.	.02 K. W.	60.00
4285	50	100-150	0-1.5	.02	55.00
4286	50	200-250	0-2	.05	60.00
4288	50	200-250	0-2	.05	55.00
4290	25	200-250	0-2	.1	60.00
4294	25	100-150	0-4	.1	55.00
4296	50	200-250	0-7.5	.1	60.00

DIRECTIONS FOR ORDERING: Specify quantity, catalog number, frequency and exact operating voltage.

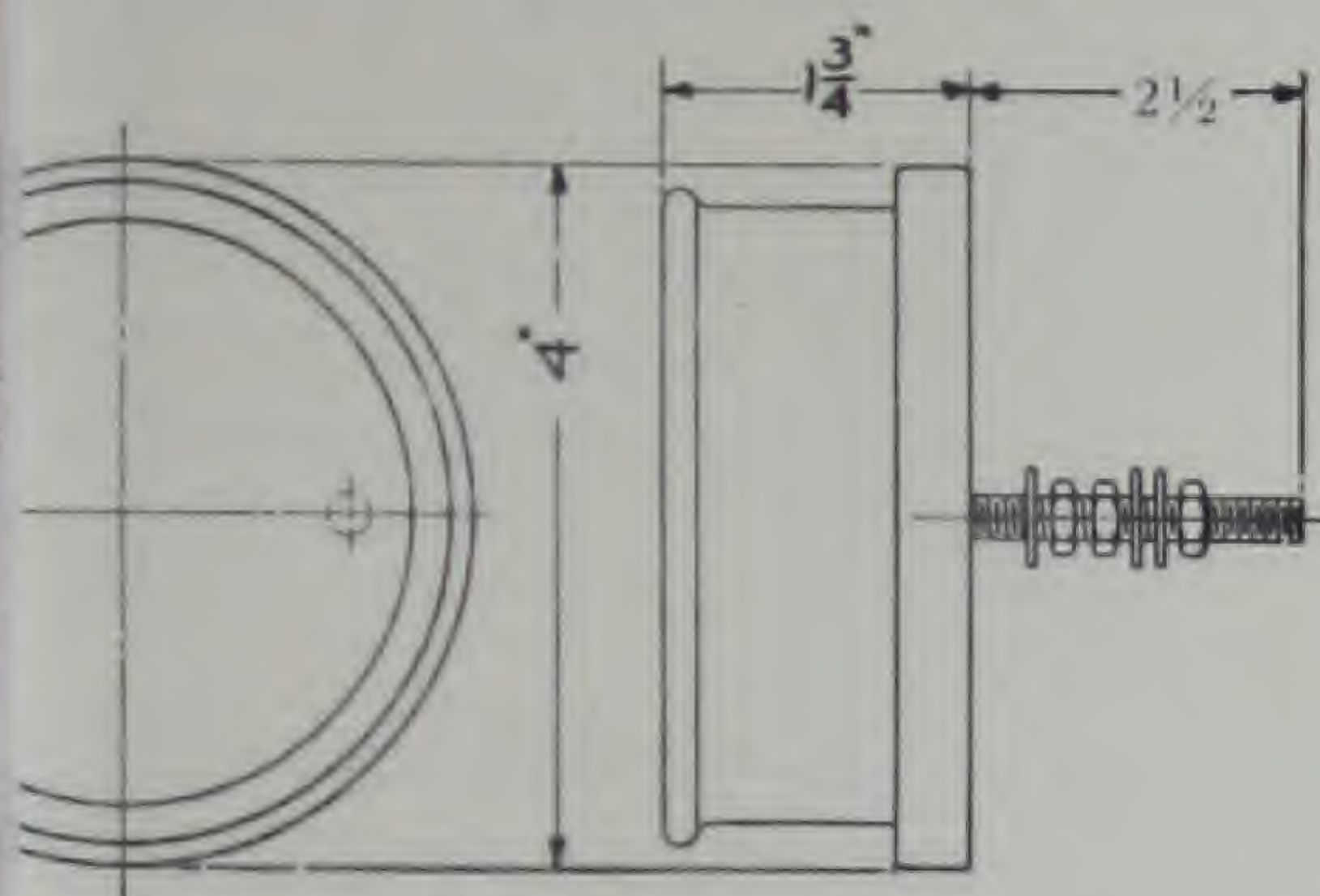
Dimensions of Types TA and FA Instruments



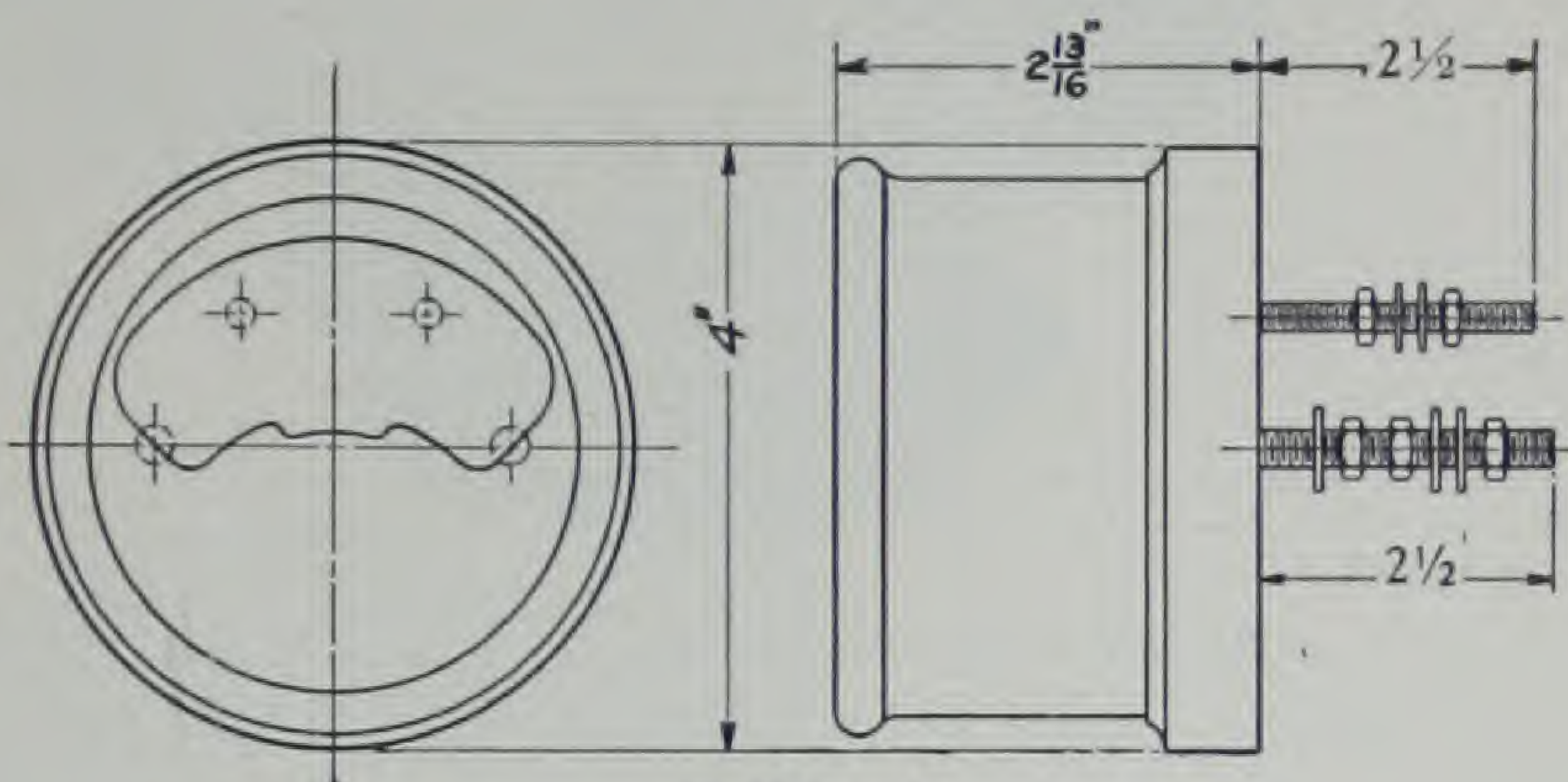
TYPE TA
Ammeter or Voltmeter—Surface Model
Weight $\frac{3}{4}$ lb. Shipping Weight 1 lb.



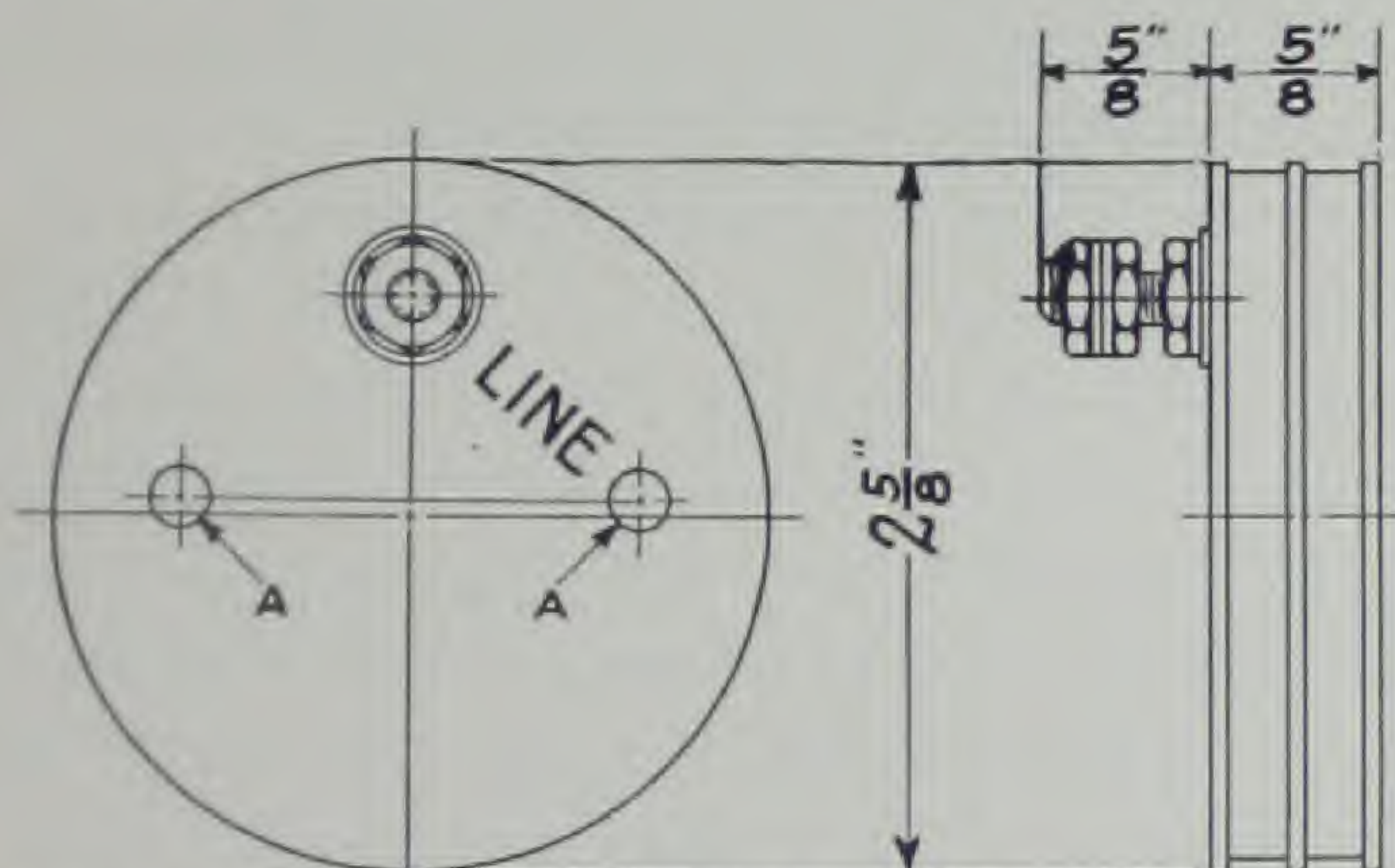
TYPE TA
Ammeter or Voltmeter—Flush Model
Body Diameter of flush Bakelite Case is $2\frac{3}{4}$ "
Net Weight $\frac{3}{4}$ lb. Shipping Weight 1 lb.



TYPE FA
Ammeter or Voltmeter—Surface Model
Weight $1\frac{1}{4}$ lbs. Shipping Weight $1\frac{1}{2}$ lbs.

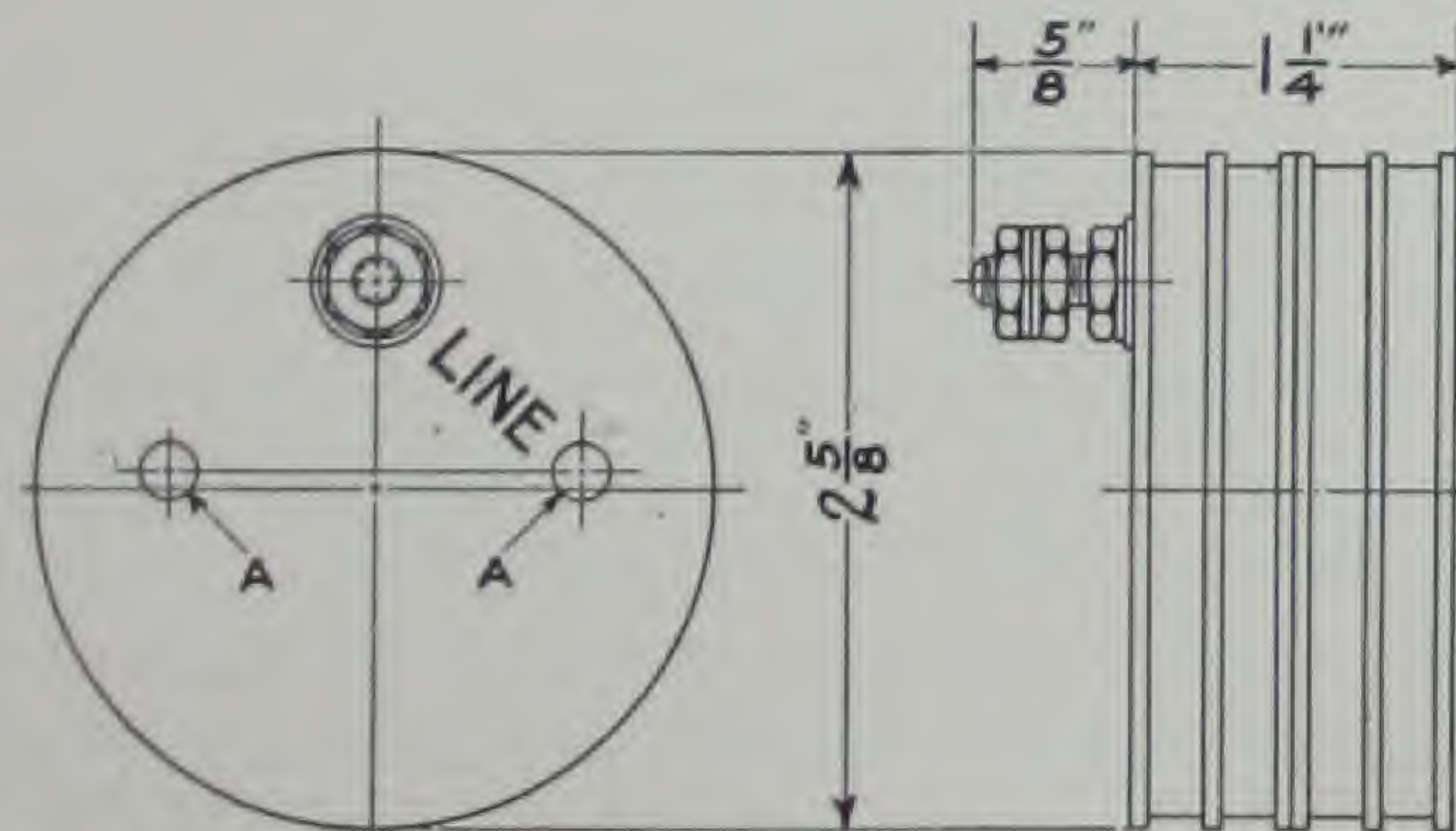


TYPE FA
Wattmeter—Surface Model
Net Weight $2\frac{1}{2}$ lbs. Shipping Weight 5 lbs.



HOLES A-A FIT OVER INSTRUMENT STUDS.

Disc Type Resistor Supplied with TYPE TA Voltmeters, 75, 100 and 150 Volts.



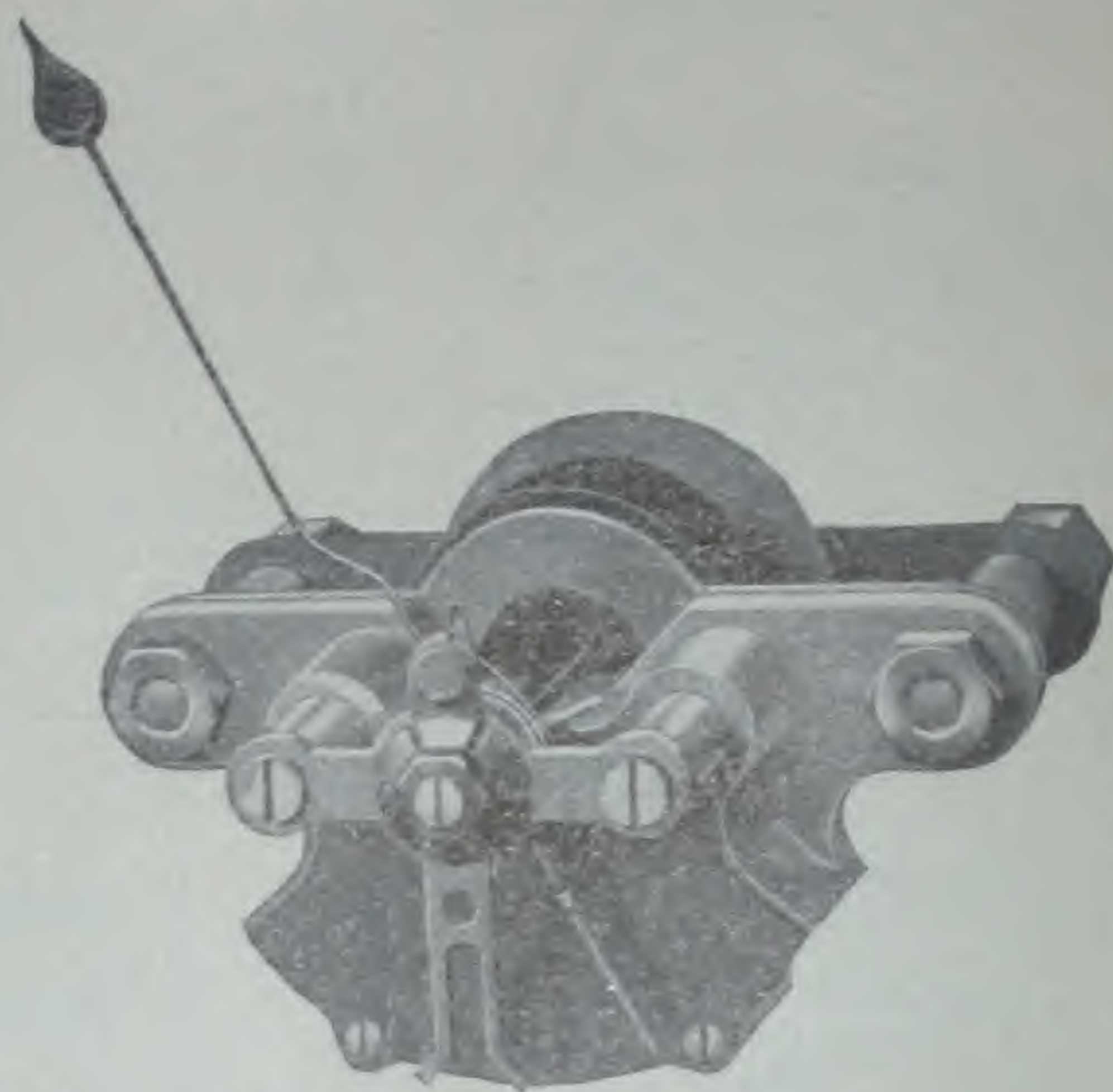
HOLES A-A FIT OVER INSTRUMENT STUDS.

Disc Type Resistor Supplied with TYPE TA Voltmeters, 300 Volts.

All Dimensions are Approximate and for Reference Purposes only.

Alternating Current Switchboard Instruments

Types SA, RA, NA and HEA



On this page we give the essential details that are common to all the instruments on pages 23 to 34 (except as noted).

Reference to the illustrations will show the pleasing appearance of these instruments and the open, well lighted and easily read scales.

Our well-known black rubberoid finish has been adopted as standard after many years of experience with various finishes. It is durable and will not tarnish nor oxidize. Special finishes can be supplied at an extra charge and prices will be quoted on application.

Sturdy—but light—steel cases are standard and all instruments are dust and moisture proof. When we are advised that instruments are to be used under damp or tropical conditions special precautions are taken to adapt the instruments for those conditions. Flush type instruments can be furnished in certain types—see listings for details.

Connections (for back connected instruments) are in the form of rear studs so arranged that they cannot turn and a full complement of nuts and washers is supplied. In mounting an instrument it is necessary to drill only the holes for the studs, which studs are provided with holding nuts to secure the instrument firmly in place. Front connected instruments can be supplied in certain types—see listings for details.

Ammeters, Voltmeters and Wattmeters are exceptionally well damped by means of a light but rigid aluminum air vane rotating in a die cast chamber.

Dials are of pure white bristol board of the highest grade and the scales are drawn in by hand in accordance with the characteristics of each instrument. Non-fading black India ink, which retains its legibility indefinitely, is used in all types.

Glasses are free from flaws and are firmly cemented in place.

Ammeters, Voltmeters and Wattmeters of all types except the HEA and Triplex are provided with a convenient and efficient zero adjuster.

Springs are of phosphor-bronze, well aged to minimize zero shifting.

Mechanisms are so mounted that the parts cannot get out of alignment.

Ammeters and Voltmeters have mechanisms of the electro-magnet type and Wattmeters and Power Factor Meters of the electro-dynamometer type.

Frequency meters should be operated for best accuracy with the voltage within 10% plus or minus of the normal value. Power factor meters should not be operated on currents below 60% of normal if best accuracy is desired.

Ammeters, Voltmeters and Wattmeters are accurate within $1\frac{1}{4}\%$ of full scale value at any point on the scale; Frequency Meters are accurate within $\frac{3}{4}$ of 1% of normal frequency.

All instruments are accurate on all frequencies up to and including 133 cycles.

Other details not common to these types SA, RA, NA and HEA instruments will be found in the section devoted to each particular type.

TYPE SA

(7½" diameter)

This page and the two pages following cover our Type SA Ammeters, Voltmeters, Single and Polyphase Wattmeters, Frequency Meters and Power Factor Meters, all 7½" in diameter. The depth is 3½" except for the Polyphase Wattmeters which have a small ¾" projection on the front (as shown). See length is 5". Type SA instruments are recommended especially for medium size panels and other places where space is a consideration. Complete dimensions are given on page 35.

TYPE SA

(7½" diameter)

Ammeters and Voltmeters



AMMETERS

	†Range in Amps.	Value Per Division	List Price
is	5 Amp. Capacity	Scale to Suit Transformer	\$31.50
is	0- 5	.1	31.50
is	0- 10	.2	31.50
is	0- 15	.2	31.50
is	0- 25	.5	31.50
is	0- 50	1.	32.00
is	0- 75	1.	32.00
is	0-100	2.	32.00
is	0-150	2.	33.75
is	0-200	5.	34.50
is	0-300	5.	36.00

VOLTMETERS

Cat. No.	†Range in Volts	Value Per Division	List Price
4516s	150 Volts Capacity	Scale to Suit Transformer	\$35.00
4509s	0- 75	1.	34.00
4510s	0-150	2.	35.00
4511s	0-300	5.	39.50
*4512s	0-500	10.	45.75
*4513s	0-600	10.	46.00

* Has external resistor.

is indicates stock item.
† Values are readable from about 20% to 100% of full scale value.

Average net weight per instrument is 5½ pounds; shipping weight 10 pounds.

For ammeters with ranges higher than 300 amperes, add to the price of Cat. No. 4515, 5 ampere meter the price of the appropriate current transformer.

Ammeters ordinarily supplied as series devices (300 amperes and under), can be furnished as shunt devices for use with current transformers, prices being figured as in preceding paragraph. This combination should always be used where the line voltage exceeds 600 volts.

For voltmeters with ranges above 600 volts, add to the price of the Cat. No. 4516, 150 volt instrument the price of the appropriate potential transformer.

Switchboard type current and potential transformers are listed on pages 42 and 43.

Flush type cases can be supplied at an extra charge. Prices on application.

Front connected instruments can be furnished at an extra charge. Prices on application.

In ordering, specify quantity, catalog number, special features if any, and transformer ratios where instruments are used with external transformers.

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

TYPE SA

(7½" diameter)

Wattmeters

Single Phase and Polyphase

(Reactive Kilovolt Ampere Meters can be furnished. Prices on application.)



SINGLE PHASE WATTMETERS

Cat. No.	Amperes	Volts	†Scale	List Price
4734a	5	100-150	To Suit Trans.	\$67.25
4735a	5	200-300	"	71.75
*4736a	5	400-600	"	75.00
4703a	5	100-150	0-.7 K.W.	67.25
4701a	5	200-300	0-1.5 "	71.75
*4702a	5	400-600	0-2.5 "	75.00
4703	10	100-150	0-1.5 "	67.25
4704	10	200-300	0-2.5 "	71.75
*4705	10	400-600	0-5 "	75.00
4706	15	100-150	0-2 "	67.25
4707	15	200-300	0-4 "	71.75
*4708	15	400-600	0-7.5 "	75.00
4709	25	100-150	0-3.5 "	67.25
4710	25	200-300	0-7 "	71.75
*4711	25	400-600	0-15 "	75.00
4712	50	100-150	0-7 "	67.25
4713	50	200-300	0-15 "	71.75
*4714	50	400-600	0-30 "	75.00

POLYPHASE WATTMETERS

Cat. No.	Amperes	Volts	†Scale	List Price
4727a	5	100-150	To Suit Trans.	\$99.00
*4728a	5	200-300	"	108.00
*4729a	5	400-600	"	111.00
4721a	5	100-150	0-1.5 K.W.	99.00
*4722a	5	200-300	0-2.5 "	108.00
*4723a	5	400-600	0-5 "	111.00

*a" indicates stock item.

*Has external resistor for potential circuit.

†Scales are readable throughout their entire length and the scale divisions are practically uniform.

Average net weight per instrument is 8 pounds; shipping weight 14 pounds.

For wattmeters with ampere capacities higher than those listed use 5 ampere instruments with external current transformers.

For wattmeters with voltage capacities higher than those listed use external potential and current transformers.

Indicating wattmeters for use with transformers are calibrated for such use without extra charge. The resulting scales, of course, depend on the transformer ratios involved but are in proportion to those listed on this sheet.

Switchboard type current and potential transformers are listed on pages 42 and 43.

Flush type cases can be supplied at an extra charge. Prices on application.

In ordering, specify quantity, catalog number, special features if any, operating voltage and frequency, and, in those cases where instruments are to be used with external current or potential transformers, the ratios of such transformers.

TYPE SA

(7½" diameter)

Frequency Meters and Power Factor Meters

(Reactive Factor Meters can be furnished. Prices on application.)



FREQUENCY METERS

Cat. No.	(Cycles)	Volts	List Price
4724	15-35	100-150	\$83.00
4725	15-35	200-300	91.00
*4726	15-35	400-600	99.00
4716	30-60	100-150	83.00
4717	30-60	200-300	91.00
*4718	30-60	400-600	99.00
4727s	45-75	100-150	83.00
4728	45-75	200-300	91.00
*4729	45-75	400-600	99.00
4730	105-155	100-150	83.00
4731	105-155	200-300	91.00
*4732	105-155	400-600	99.00
4733	400-600	100-150	83.00
4744	400-600	200-300	101.00
*4745	400-600	400-600	109.00

POWER FACTOR METERS

Cat. No.	Amps.	Volts	(Scale)	Phases	Wires	List Price
4746s	5	100-150	.50-1.00-.50	3	3	\$75.00
*4747	5	200-300	.50-1.00-.50	3	3	83.00
*4748	5	400-600	.50-1.00-.50	3	3	99.00
4749	5	100-150	.50-1.00-.50	2	3	75.00
*4750	5	200-300	.50-1.00-.50	2	3	83.00
*4751	5	400-600	.50-1.00-.50	2	3	99.00
4752s	5	100-150	.50-1.00-.50	2	4	75.00
*4753	5	200-300	.50-1.00-.50	2	4	83.00
*4754	5	400-600	.50-1.00-.50	2	4	99.00

s" indicates stock item.

*Has external resistor.

†Scales are readable throughout their entire length.

We call particular attention to the remarkably long and uniform scale of the frequency meters.

Average net weight per instrument is 8 pounds; shipping weight 14 pounds.

For power factor meters with ampere capacities higher than 5 amperes use external current transformers with the 5 ampere instruments.

For power factor meters for voltages higher than those listed use external potential transformers and external current transformers.

For frequency meters for voltages higher than those listed use external voltage transformers.

Switchboard type current and potential transformers are listed on pages 42 and 43.

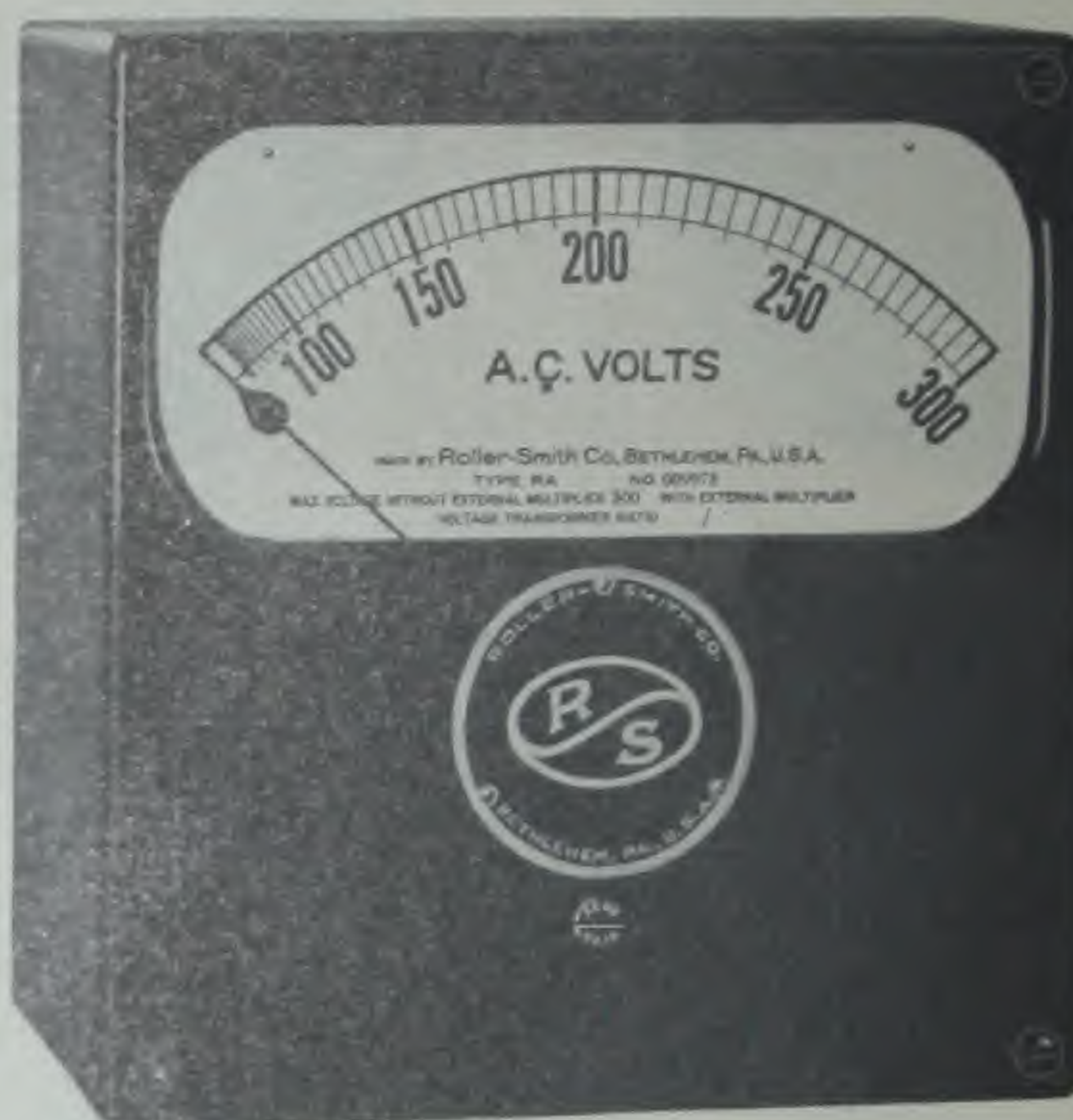
Flush type cases can be supplied at an extra charge. Prices on application.

In ordering, specify quantity, catalog number, special features if any, operating voltage and frequency, and, in those cases where instruments are to be used with external current or potential transformers, the ratios of such transformers.

Type RA (Rectangular)

On this page and the two pages following we list our Type RA Ammeters, Voltmeters, Single Phase and Polyphase Wattmeters, Frequency Meters and Power Factor Meters. These are all rectangular in shape and have dimensions of 5 $\frac{5}{8}$ " wide, 6" high and 3 $\frac{3}{4}$ " deep except for the Polyphase Wattmeter, which has a small 25/32" projection on the front. Scale length is 5 $\frac{3}{16}$ ". Type RA instruments are designed for switchboards and for other applications where the space available requires minimum space wastage. The Type RD possesses this advantage over the conventional round pattern instruments. Complete dimensions are given on Page 36.

Type RA (Rectangular) Ammeters and Voltmeters



AMMETERS

Cat. No.	**Range in Amps.	Amp. Value Per Division	List Price
4617	5 Amp. Capacity	Scale to Suit Transformer	\$37.50
4618	0-5	.1	37.50
4619	0-10	.2	37.50
4620	0-15	.2	37.50
4621	0-25	.5	37.50
4622	0-50	1.	38.00
4623	0-75	1.	38.00
4624	0-100	2.	38.00
4625	0-150	2.	39.00
4626	0-200	5.	40.50
4627	0-300	5.	43.00

VOLTMETERS

Cat. No.	**Range in Volts	Value per Division	List Price
4629	150 Volts Capacity	Scale to Suit Transformer	\$40.25
4630	0-75	1.	39.75
4631	0-150	2.	40.25
4632	0-300	5.	45.50
*4633	0-500	10.	51.25
*4634	0-600	10.	52.00

*Has external resistor.

** Scales are readable from about 20% to 100% of full scale value.

For Ammeters with ranges higher than 300 amperes, add to the price of Cat. No. 4617, 5 ampere ammeter the price of the appropriate current transformer.

Ammeters ordinarily supplied as series devices (300 amperes and under), can be furnished as 5 ampere devices for use with current transformers, prices being figured as in preceding paragraph. This combination should always be used where the line voltage exceeds 600 volts.

For voltmeters with ranges above 600 volts, add to the price of the Cat. No. 4629, 150 volt instrument, the price of the appropriate potential transformer.

Switchboard type current and potential transformers are listed on pages 42 and 43.

In ordering, specify quantity, catalog number, special features, if any, and transformer ratios where instruments are used with external transformers.

Type RA (Rectangular) WATTMETERS

Single Phase and Polyphase

(Reactive Kilovolt Ampere Meters can be furnished. Prices on application.)



SINGLE PHASE WATTMETERS

Cat. No.	Amperes	Volts	Scale	List Price
4635	5	100-150	To Suit Trans.	\$67.25
4636	5	200-300	"	71.75
*4637	5	400-600	"	75.00
4638	5	100-150	0-7 K.W.	67.25
4639	5	200-300	0-1.5 "	71.75
*4640	5	400-600	0-2.5 "	75.00
4641	10	100-150	0-1.5 "	67.25
4642	10	200-300	0-2.5 "	71.75
*4643	10	400-600	0-5 "	75.00
4644	15	100-150	0-2 "	67.25
4645	15	200-300	0-4 "	71.75
*4646	15	400-600	0-7.5 "	75.00
4647	25	100-150	0-3.5 "	67.25
4648	25	200-300	0-5 "	71.75
*4649	25	400-600	0-15 "	75.00
4650	50	100-150	0-7 "	67.25
4651	50	200-300	0-15 "	71.75
*4652	50	400-600	0-30 "	75.00

POLYPHASE WATTMETERS

Cat. No.	Amperes	Volts	Scale	List Price
4653	5	100-150	To Suit Trans.	\$99.00
*4654	5	200-300	"	148.00
*4655	5	400-600	"	148.00
4656	5	100-150	0-1.5 K.W.	99.00
*4657	5	200-300	0-2.5 "	148.00
*4658	5	400-600	0-5 "	148.00

*Has external resistor for potential circuit.

†Scales are readable throughout their entire length and the scale divisions are practically uniform.

For wattmeters with ampere capacities higher than those listed use 5 ampere instruments with external current transformers. For wattmeters with voltage capacities higher than those listed use external potential and current transformers. See pages 42 and 43 for listing of transformers.

Indicating wattmeters for use with transformers are calibrated for such use without extra charge. The resulting ratios involved are in proportion to those listed on this sheet.

In ordering, specify quantity, catalog number, special features, if any, normal operating voltage and frequency, and in those cases where instruments are to be used with external current or potential transformers the ratios of such transformers.

Type RA (Rectangular)

Frequency Meters and Power Factor Meters

(Reactive Factor Meters can be furnished. Prices on application.)



FREQUENCY METERS

Cat. No.	Cycles	Volts	List Price
4000	15-35	100-150	\$83.00
4001	15-35	200-300	91.00
*4002	15-35	400-600	99.00
4003	25-60	100-150	83.00
4004	25-60	200-300	91.00
*4005	25-60	400-600	99.00
4006	45-75	100-150	83.00
4007	45-75	200-300	91.00
*4008	45-75	400-600	99.00
4009	105-155	100-150	83.00
4010	105-155	200-300	91.00
*4011	105-155	400-600	99.00
4012	400-600	100-150	93.00
4013	400-600	200-300	101.00
*4014	400-600	400-600	109.00

POWER FACTOR METERS

Cat. No.	Amps.	Volts	Scale	Phases	Wires	List Price
4015	5	100-150	.50-1.00-.50	3	3	\$75.00
*4016	5	200-300	.50-1.00-.50	3	3	83.00
*4017	5	400-600	.50-1.00-.50	3	3	99.00
4018	5	100-150	.50-1.00-.50	2	3	75.00
*4019	5	200-300	.50-1.00-.50	2	3	83.00
*4020	5	400-600	.50-1.00-.50	2	3	99.00
4021	5	100-150	.50-1.00-.50	2	4	75.00
*4022	5	200-300	.50-1.00-.50	2	4	83.00
*4023	5	400-600	.50-1.00-.50	2	4	99.00

*Has external resistor.

°Scales are readable throughout their entire length.

For power factor meters with ampere capacities higher than 5 amperes use external current transformers with the 5 ampere instruments.

For power factor meters for voltages higher than those listed use external potential transformers and external current transformers.

For frequency meters for voltages higher than those listed use external potential transformers.

Switchboard type current and potential transformers are listed on pages 42 and 43.

In ordering, specify quantity, catalog number, special features if any, normal operating voltage and frequency, and, in those cases where instruments are to be used with external current or potential transformers, the ratios of such transformers.

TYPE NA

(9 1/16" diameter)

On this and the two pages following we list our Type NA Ammeters, Voltmeters, Single Phase and Polyphase Wattmeters, Frequency Meters and Power Factor Meters. These are all 9 1/16" in diameter and 1 1/4" deep except for the Polyphase Wattmeter, which has a small 3/4" projection on the front. Scale length is 6 1/4". Type NA instruments are designed for large switchboards and for other applications where a long scale, round pattern instrument is needed. Complete dimensions are given on page 35.

TYPE NA

(9 1/16" diameter)

Ammeters and Voltmeters



AMMETERS

Cat. No.	†Range in Amps.	Value Per Division	List Price
555s	5 Amp. Capacity	Scale to Suit Transformer	\$39.75
550s	0- 5	.1	39.75
551	0- 10	.2	39.75
552	0- 15	.2	39.75
553	0- 25	.5	39.75
554	0- 50	1.	41.00
555	0- 75	1.	41.00
556	0-100	2.	41.00
555	0-150	2.	42.00
557	0-200	5.	43.25
558	0-300	5.	44.25

VOLTMETERS

Cat. No.	†Range in Volts	Value Per Division	List Price
4566s	150 Volts Capacity	Scale to Suit Transformer	\$44.00
4559s	0- 75	1.	43.25
4560s	0-150	2.	44.00
4561s	0-300	5.	49.50
*4562s	0-500	10.	54.50
*4563s	0-600	10.	55.25

* Has external resistor.

s" indicates stock item.

Scales are readable from about 20% to 100% of full scale value.

Average net weight per instrument is 11 pounds; shipping weight 18 pounds.

For ammeters with ranges higher than 300 amperes, add to the price of Cat. No. 4565, 5 ampere ammeter the price of the appropriate current transformer.

Ammeters ordinarily supplied as series devices (300 amperes and under), can be furnished as shunt devices for use with current transformers, prices being figured as in preceding paragraph. This combination should always be used where the line voltage exceeds 600 volts.

For voltmeters with ranges above 600 volts, add to the price of the Cat. No. 4566, 150 volt instrument the price of the appropriate potential transformer.

Switchboard type current and potential transformers are listed on pages 42 and 43.

Flush type cases can be supplied at an extra charge. Prices on application.

Front connected instruments can be furnished at an extra charge. Prices on application.

In ordering, specify quantity, catalog number, special features if any, and transformer ratios when instruments are used with external transformers.

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

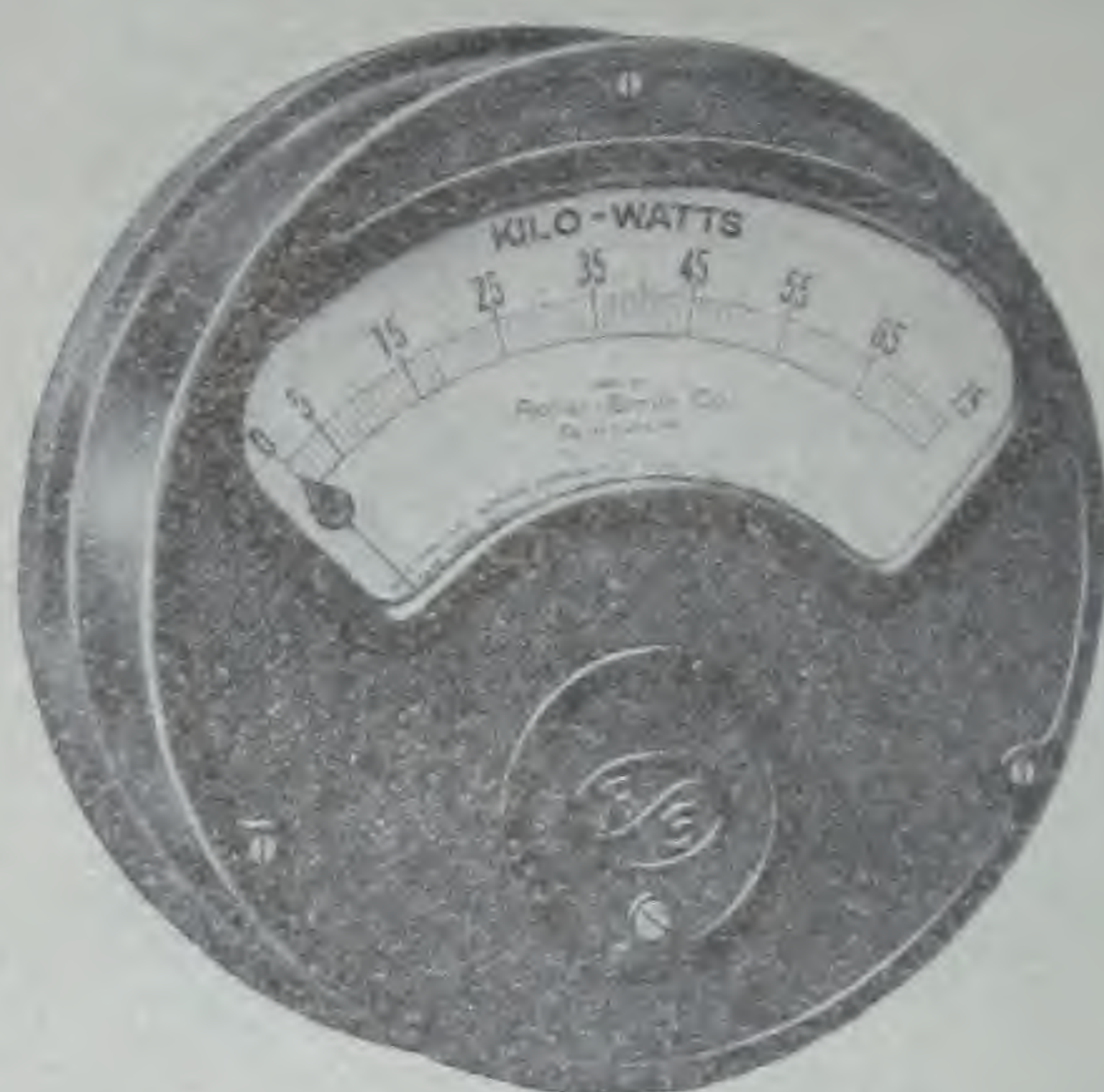
TYPE NA

(9 $\frac{1}{16}$ " diameter)

Wattmeters

Single Phase and Polyphase

(Reactive Kilovolt Ampere Meters can be furnished. Prices on application.)



SINGLE PHASE WATTMETERS

Cat. No.	Amperes	Volts	†Scale	List Price
4780	5	100-150	To Suit Trans.	\$73.00
4781	5	200-300	"	77.25
*4782	5	400-600	"	81.25
4765	5	100-150	0-7 K.W.	73.00
4766	5	200-300	0-1.5 "	77.25
*4767	5	400-600	0-2.5 "	81.25
4768	10	100-150	0-1.5 "	73.00
4769	10	200-300	0-2.5 "	77.25
*4770	10	400-600	0-5 "	81.25
4771	15	100-150	0-2 "	73.00
4772	15	200-300	0-4 "	77.25
*4773	15	400-600	0-7.5 "	81.25
4774	25	100-150	0-3.5 "	73.00
4775	25	200-300	0-7 "	77.25
*4776	25	400-600	0-15 "	81.25
4777	50	100-150	0-7 "	73.00
4778	50	200-300	0-15 "	77.25
*4779	50	400-600	0-30 "	81.25

POLYPHASE WATTMETERS

Cat. No.	Amperes	Volts	†Scale	List Price
4783s	5	100-150	To Suit Trans.	\$102.50
*4784s	5	200-300	"	110.00
*4785s	5	400-600	"	114.50
4786s	5	100-150	0-1.5 K.W.	102.50
*4787s	5	200-300	0-2.5 "	110.00
*4788s	5	400-600	0-5 "	114.50

"s" indicates stock item.

*Has external resistance for potential circuit.

†Scales are readable throughout their entire length and the scale divisions are practically uniform.

Average net weight per instrument is 12 pounds; shipping weight 19 pounds.

For wattmeters with ampere capacities higher than those listed use 5 ampere instruments with external current transformers.

For wattmeters with voltage capacities higher than those listed use external potential and external current transformers.

Indicating wattmeters for use with transformers are calibrated for such use without extra charge. The resulting scales, of course, depend on the transformer ratios involved but are in proportion to those listed on this sheet.

Switchboard type current and potential transformers are listed on pages 42 and 43.

Flush type cases can be supplied at an extra charge. Prices on application.

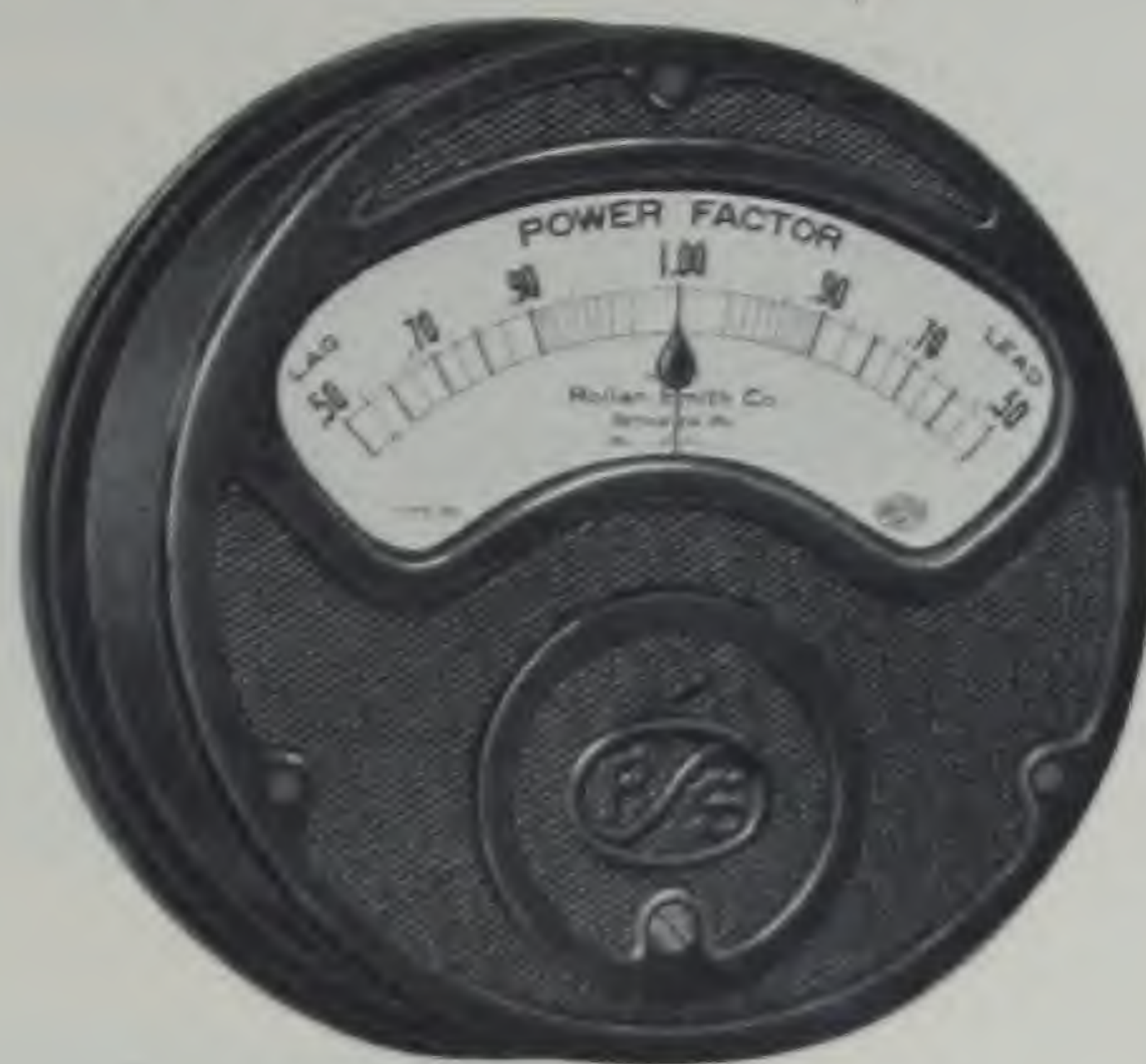
In ordering, specify quantity, catalog number, special features if any, operating voltage and frequency, and, in those cases where instruments are to be used with external current or potential transformers, the ratios of such transformers.

TYPE NA

(9 $\frac{1}{8}$ " diameter)

Frequency Meters and Power Factor Meters

(Reactive Factor Meters can be furnished. Prices on application)



FREQUENCY METERS

St. No.	Cycles	Volts	List Price
789	15-35	100-150	\$87.75
790	15-35	200-300	94.00
791	15-35	400-600	101.75
782	30-60	100-150	87.75
783	30-60	200-300	94.00
784	30-60	400-600	101.75
792	45-75	100-150	87.75
793	45-75	200-300	94.00
794	45-75	400-600	101.75
795	105-155	100-150	87.75
796	105-155	200-300	94.00
797	105-155	400-600	101.75
798	400-600	100-150	97.75
799	400-600	200-300	104.00
800	400-600	400-600	111.75

POWER FACTOR METERS

St. No.	Amperes	Volts	Scale	Phases	Wires	List Price
801	5	100-150	.50-1.00-.50	3	3	\$80.50
802	5	200-300	.50-1.00-.50	3	3	88.00
803	5	400-600	.50-1.00-.50	3	3	102.25
804	5	100-150	.50-1.00-.50	2	3	80.50
805	5	200-300	.50-1.00-.50	2	3	88.00
806	5	400-600	.50-1.00-.50	2	3	102.25
807	5	100-150	.50-1.00-.50	2	4	80.50
808	5	200-300	.50-1.00-.50	2	4	88.00
809	5	400-600	.50-1.00-.50	2	4	102.25

as external resistor.

scales are readable throughout their entire length.

The frequency meter scales are, as will be noted, extremely long and with uniform divisions.

Average net weight per instrument 12 pounds; shipping weight 19 pounds.

For power factor meters with ampere capacities higher than 5 amperes use external current transformers with the 5 ampere instruments.

For power factor meters for voltages higher than those listed use external potential transformers and internal current transformers.

For frequency meters for voltages higher than those listed use external potential transformers.

Switchboard type current and potential transformers are listed on pages 42 and 43.

Flush type cases can be supplied at an extra charge. Prices on application.

In ordering, specify quantity, catalog number, special features if any, operating voltage and frequency, and, in those cases where instruments are to be used with external current or potential transformers ratios of such transformers.

TYPE HEA

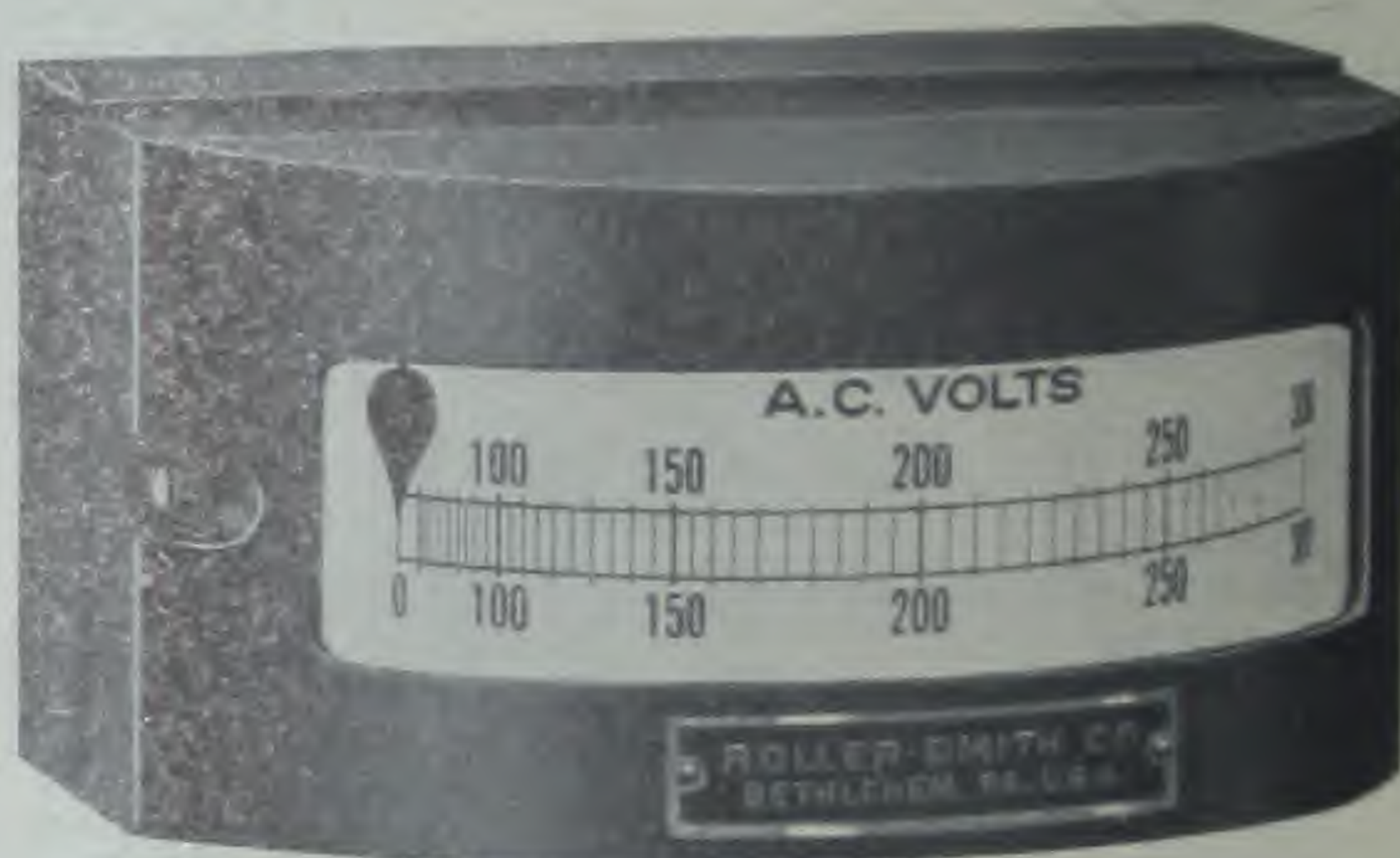
(Horizontal Edgewise)

On this and the next two pages are shown our Type HEA (horizontal edgewise) Ammeters, Voltmeters, Single Phase and Polyphase Wattmeters, Frequency Meters and Power Factor Meters. These instruments are all $9\frac{1}{2}$ " wide, $7\frac{1}{4}$ " deep and $5\frac{1}{4}$ " high, except for the Polyphase Wattmeter, which has a $\frac{1}{2}$ " projection on the top. Scale length is $7\frac{1}{8}$ ". When it is desired to utilize a minimum of space without sacrificing scale length these Type HEA instruments will be found to meet the requirements very nicely. Complete dimensions are given on page 36.

TYPE HEA

(Horizontal Edgewise)

Ammeters and Voltmeters



AMMETERS

Cat. No.	†Range in Amps.	Value Per Division	List Price
4615	5 Amp. Capacity	Scale to Suit Transformer	\$60.00
4600	0- 5	.1	60.00
4601	0- 10	.2	63.00
4602	0- 15	.2	63.00
4603	0- 25	.5	63.00
4604	0- 50	1.	65.00
4605	0- 75	1.	65.00
4606	0-100	2.	67.00

VOLTMETERS

Cat. No.	†Range in Volts	Value Per Division	List Price
4616s	150 Volts Capacity	Scale to Suit Transformer	\$75.00
4607s	0- 75	1.	74.00
4608s	0-150	2.	75.00
4609s	0-300	5.	77.00
*4610	0-500	10.	79.50
*4611	0-600	10.	81.00

* Has external resistor.

"s" indicates stock item.

†Scales are readable from about 20% to 100% of full scale value.

Average net weight per instrument is 14 pounds; shipping weight 20 pounds.

For ammeters with ranges higher than 100 amperes, add to the price of Cat. No. 4615, 5 ampere ammeter the price of the appropriate current transformer.

Ammeters ordinarily supplied as series devices (100 amperes and under), can be furnished as 5 ampere devices for use with current transformers, prices being figured as in preceding paragraph. This combination should always be used where the line voltage exceeds 600 volts.

For voltmeters with ranges above 600 volts, add to the price of the Cat. No. 4616, 150 volt instrument the price of the appropriate potential transformer.

Switchboard type current and potential transformers are listed on pages 42 and 43.

In ordering, specify quantity, catalog number, special features if any, and transformer ratios when instruments are used with external transformers.

TYPE HEA

(Horizontal Edgewise)

Wattmeters

Single Phase and Polyphase

Reactive Kilovolt Ampere Meters can be furnished. Prices on application.)



SINGLE PHASE WATTMETERS

No.	Amperes	Volts	†Scale	List Price
14	5	100-150	To Suit Trans.	\$90.00
15	5	200-300	"	100.00
16	5	400-600	"	110.00
17	5	100-150	0-7 K.W.	90.00
18	5	200-300	0-1.5 "	100.00
19	5	400-600	0-2.5 "	110.00
20	10	100-150	0-1.5 "	90.00
21	10	200-300	0-2.5 "	100.00
22	10	400-600	0-5 "	110.00
23	15	100-150	0-2 "	90.00
24	15	200-300	0-4 "	100.00
25	15	400-600	0-7.5 "	110.00
26	25	100-150	0-3.5 "	90.00
27	25	200-300	0-7 "	100.00
28	25	400-600	0-15 "	110.00
29	50	100-150	0-7 "	90.00
30	50	200-300	0-15 "	100.00
31	50	400-600	0-30 "	110.00

POLYPHASE WATTMETERS

No.	Amperes	Volts	†Scale	List Price
32	5	100-150	To Suit Trans.	\$125.00
33	5	200-300	"	135.00
34	5	400-600	"	145.00
35	5	100-150	0-1.5 K.W.	125.00
36	5	200-300	0-2.5 "	135.00
37	5	400-600	0-5 "	145.00

† external resistor for potential circuit.

Scales are readable throughout their entire length and the scale divisions are practically uniform.

Average net weight per instrument is 16 pounds; shipping weight 28 pounds.

For wattmeters with ampere capacities higher than those listed use 5 ampere instruments with external current transformers.

For wattmeters with voltage capacities higher than those listed use external potential and external current transformers.

Indicating wattmeters for use with transformers are calibrated for such use without extra charge. Resulting scales, of course, depend on the transformer ratios involved but are in proportion to those shown on this sheet.

Switchboard type current and potential transformers are listed on pages 42 and 43.

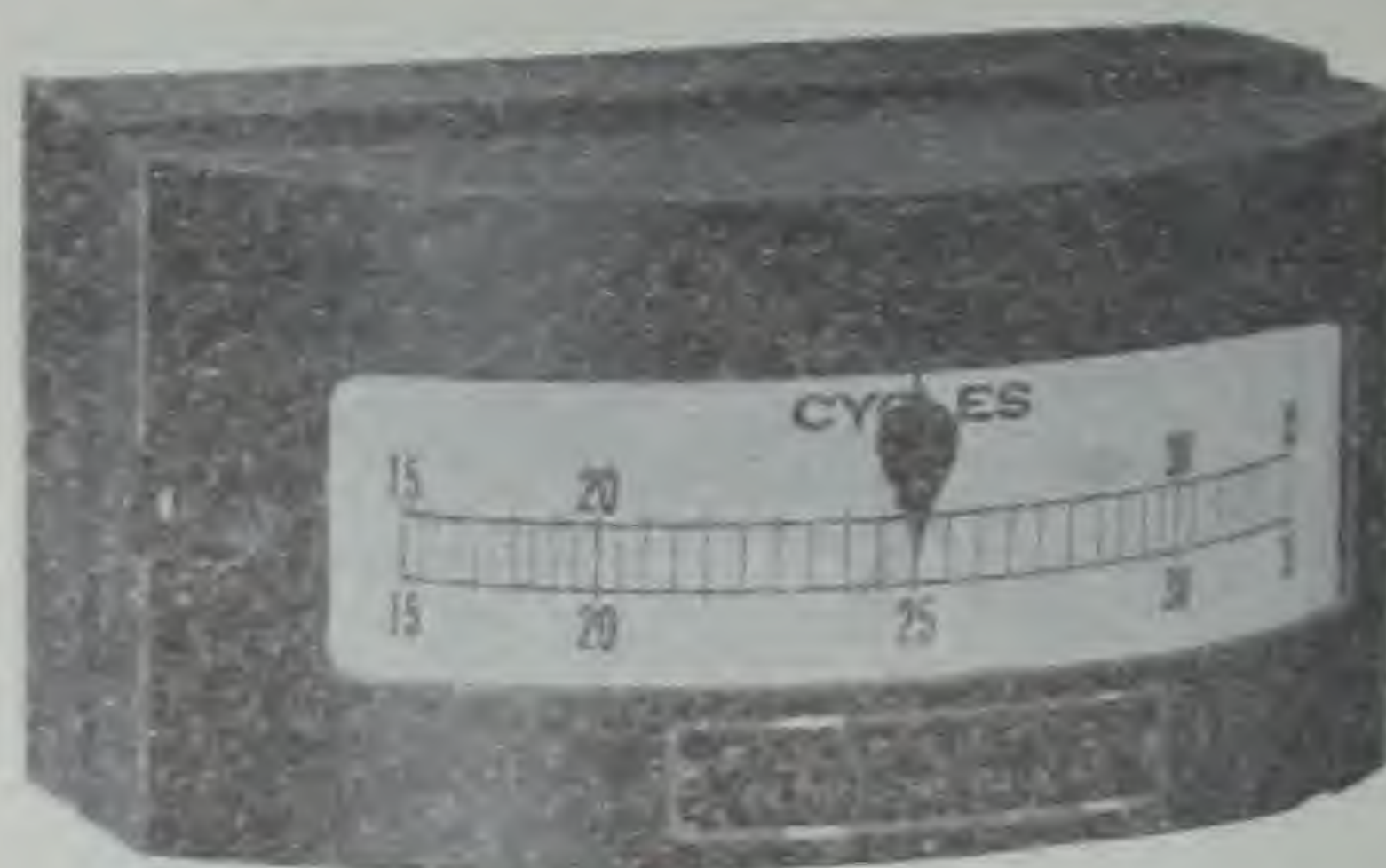
In ordering, specify quantity, catalog number, special features if any, operating voltage and frequency, and, in those cases where instruments are to be used with external current or potential transformers, ratios of such transformers.

TYPE HEA

(Horizontal Edgewise)

Frequency Meters and Power Factor Meters

(Reactive Factor Meters can be furnished. Prices on application.)



FREQUENCY METERS

Cat. No.	†Cycles	Volts	List Price
4864	15-35	100-150	\$100.00
4865	15-35	200-300	110.00
*4866	15-35	400-600	120.00
4885	30-60	100-150	100.00
4886	30-60	200-300	110.00
*4887	30-60	400-600	120.00
4867	45-75	100-150	100.00
4868	45-75	200-300	110.00
*4869	45-75	400-600	120.00
4870	105-155	100-150	100.00
4871	105-155	200-300	110.00
*4872	105-155	400-600	120.00
4873	400-600	100-150	110.00
4874	400-600	200-300	120.00
*4875	400-600	400-600	130.00

POWER FACTOR METERS

Cat. No.	Amperes	Volts	†Scale	Phases	Wires	List Price
4876s	5	100-150	.50-1.00-.50	3	3	\$90.00
*4877s	5	200-300	.50-1.00-.50	3	3	100.00
*4878s	5	400-600	.50-1.00-.50	3	3	110.00
4879	5	100-150	.50-1.00-.50	2	3	90.00
*4880	5	200-300	.50-1.00-.50	2	3	100.00
*4881	5	400-600	.50-1.00-.50	2	3	110.00
4882	5	100-150	.50-1.00-.50	2	4	90.00
*4883	5	200-300	.50-1.00-.50	2	4	100.00
*4884	5	400-600	.50-1.00-.50	2	4	110.00

"s" indicates stock item.

*Has external resistor.

†Scales are readable throughout their entire length.

The long frequency meter scale and the uniformity of the divisions are features of Roller-Smith frequency meters.

Average net weight per instrument is 16 pounds; shipping weight 28 pounds.

For power factor meters with ampere capacities higher than 5 amperes, use external current transformers with the 5. ampere instruments.

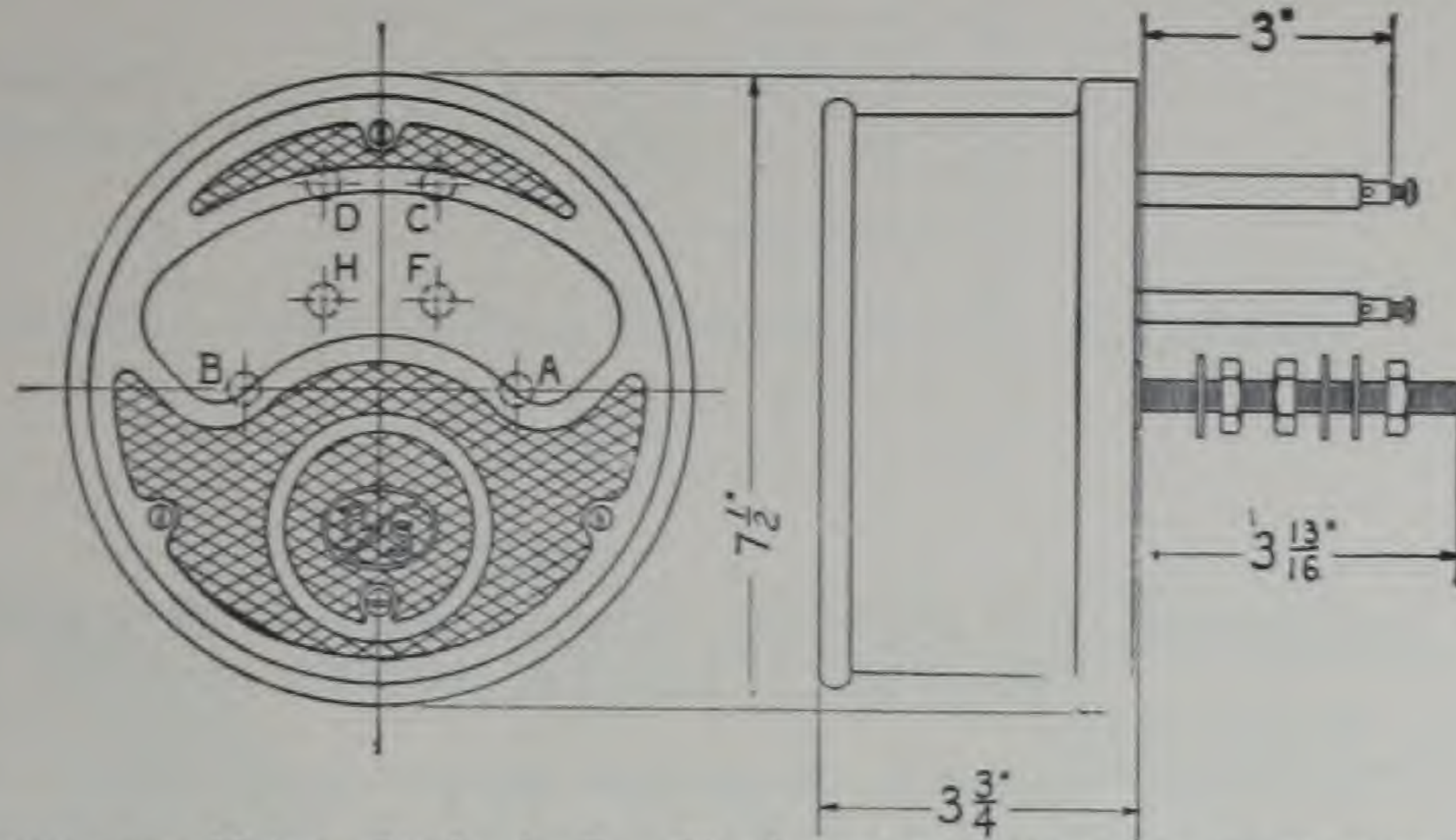
For power factor meters for voltages higher than those listed use external potential transformers and external current transformers.

For frequency meters for voltages higher than those listed use external potential transformers.

Switchboard type current and potential transformers are listed on pages 42 and 43.

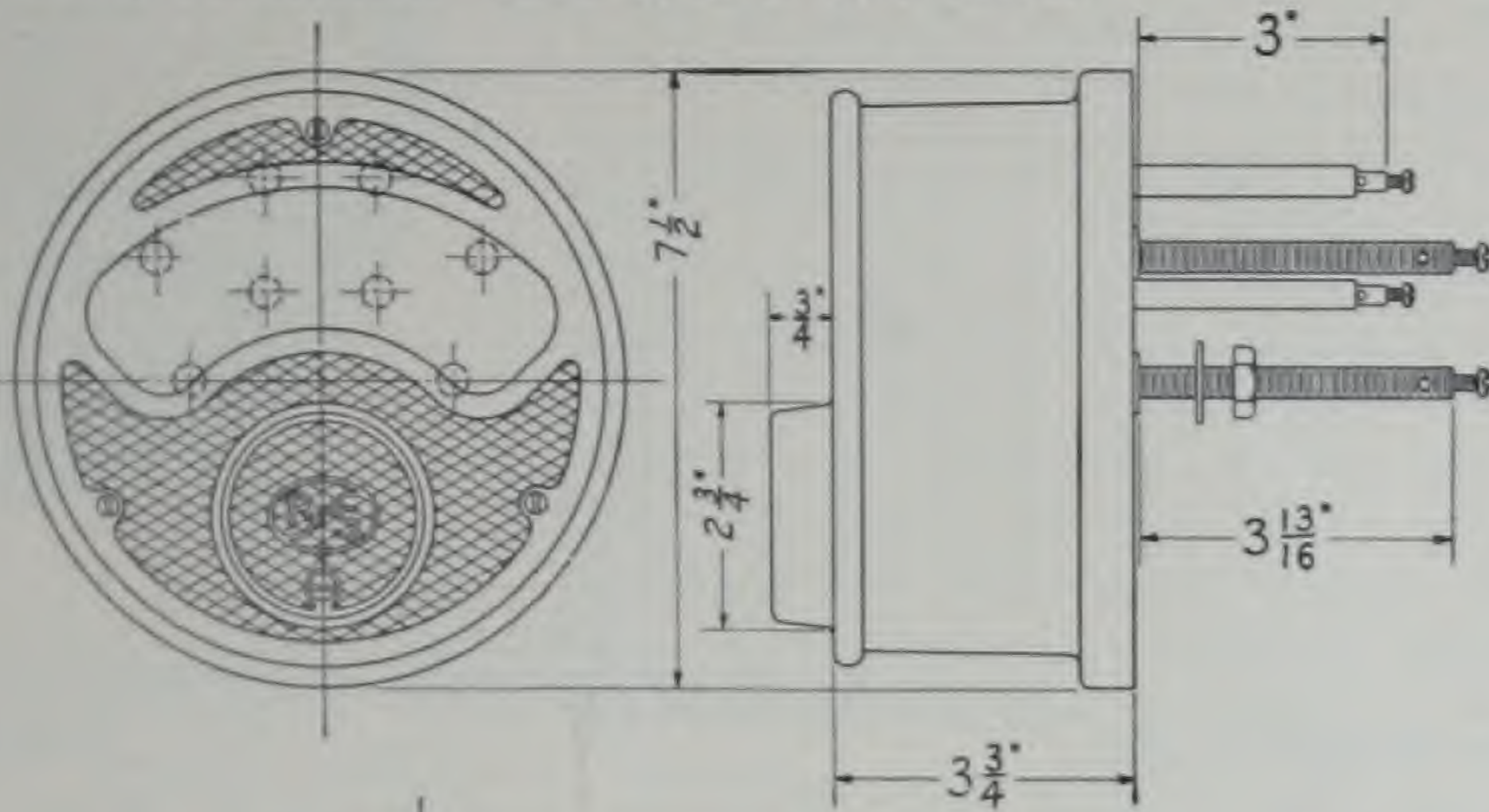
In ordering, specify quantity, catalog number, special features if any, operating voltages and frequency, and, in those cases where instruments are to be used with external current or potential transformers, the ratios of such transformers.

**TYPE
S A, A. C.
AMMETER,
VOLTMETER,
SINGLE PHASE
INDICATING
WATTMETER,
FREQUENCY
METER,
POWER FACTOR
METER.**
Net Weight, 8 Lbs.
Shipping Weight,
14 Lbs.

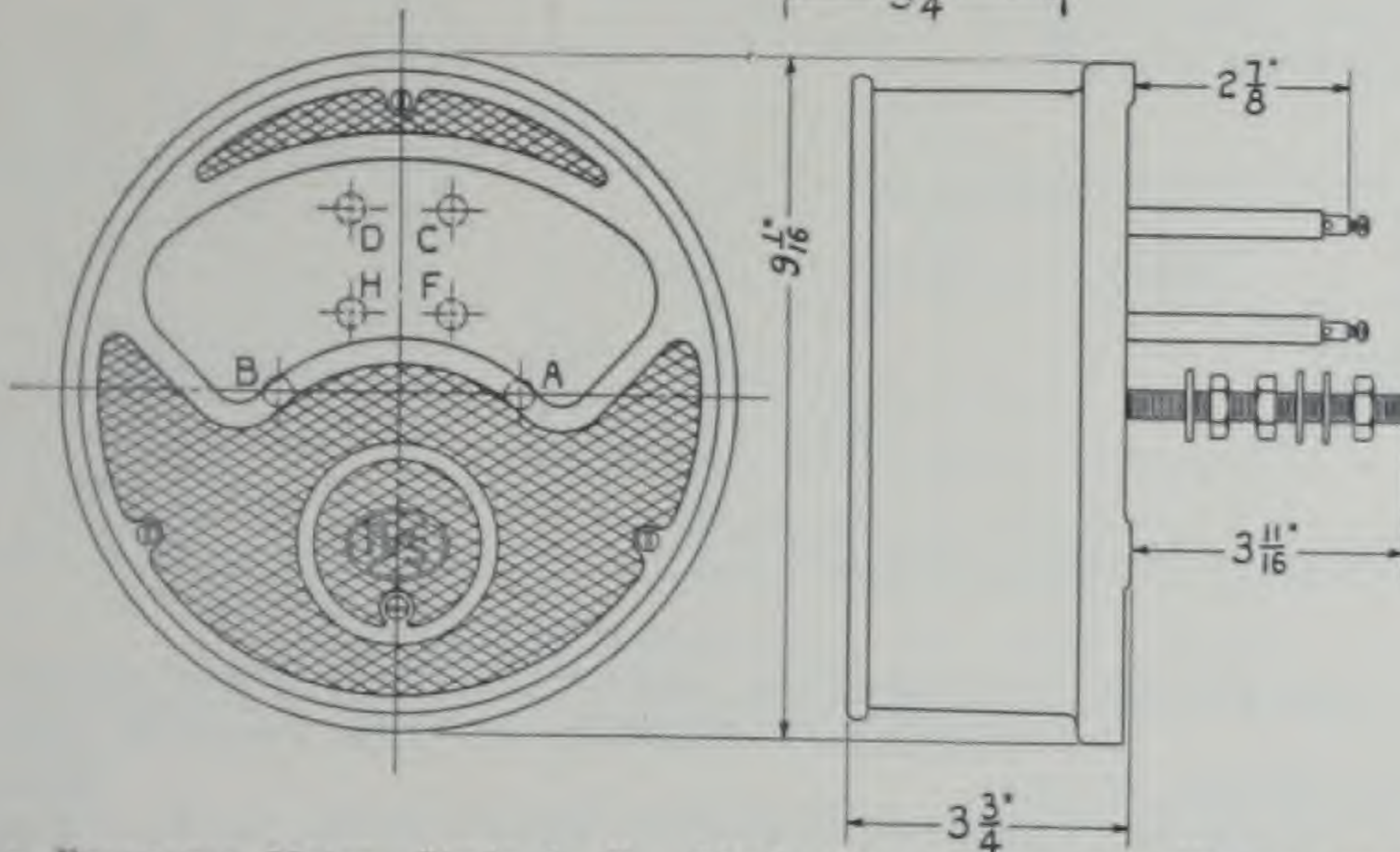


Ammeter, Voltmeter, Frequency Meter—Studs A, B. Single Phase Indicating Wattmeter—Studs A, B, C and D. Power Factor Meter—Studs A, B, C, D, F and H.

**TYPE S A
POLYPHASE
INDICATING
WATTMETER.**
Net Weight, 8 Lbs.
Shipping Weight,
14 Lbs.

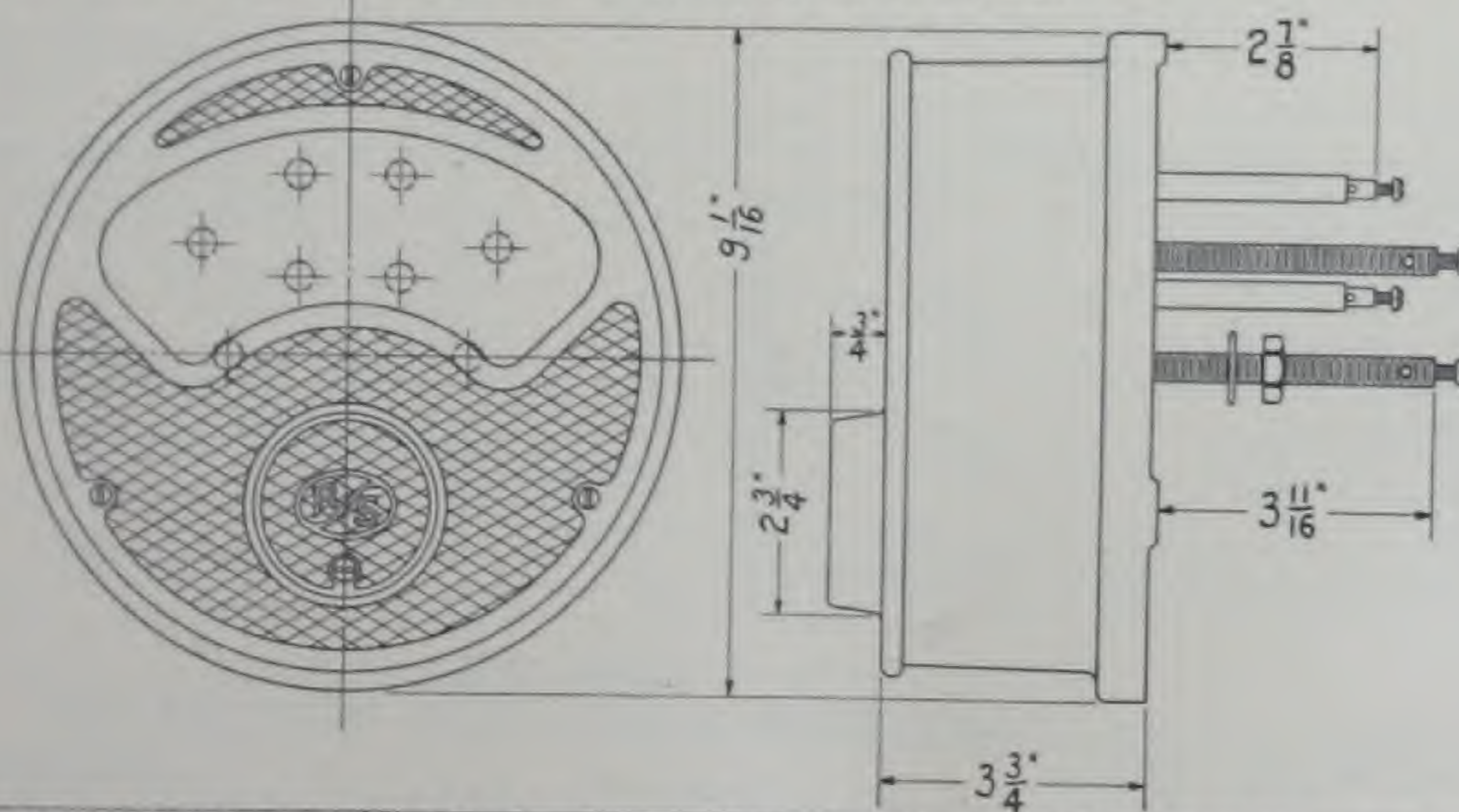


**TYPE
N A, A. C.
AMMETER,
VOLTMETER,
SINGLE PHASE
INDICATING
WATTMETER,
FREQUENCY
METER,
POWER FACTOR
METER.**
Net Weight,
12 Lbs.
Shipping Weight,
19 Lbs.

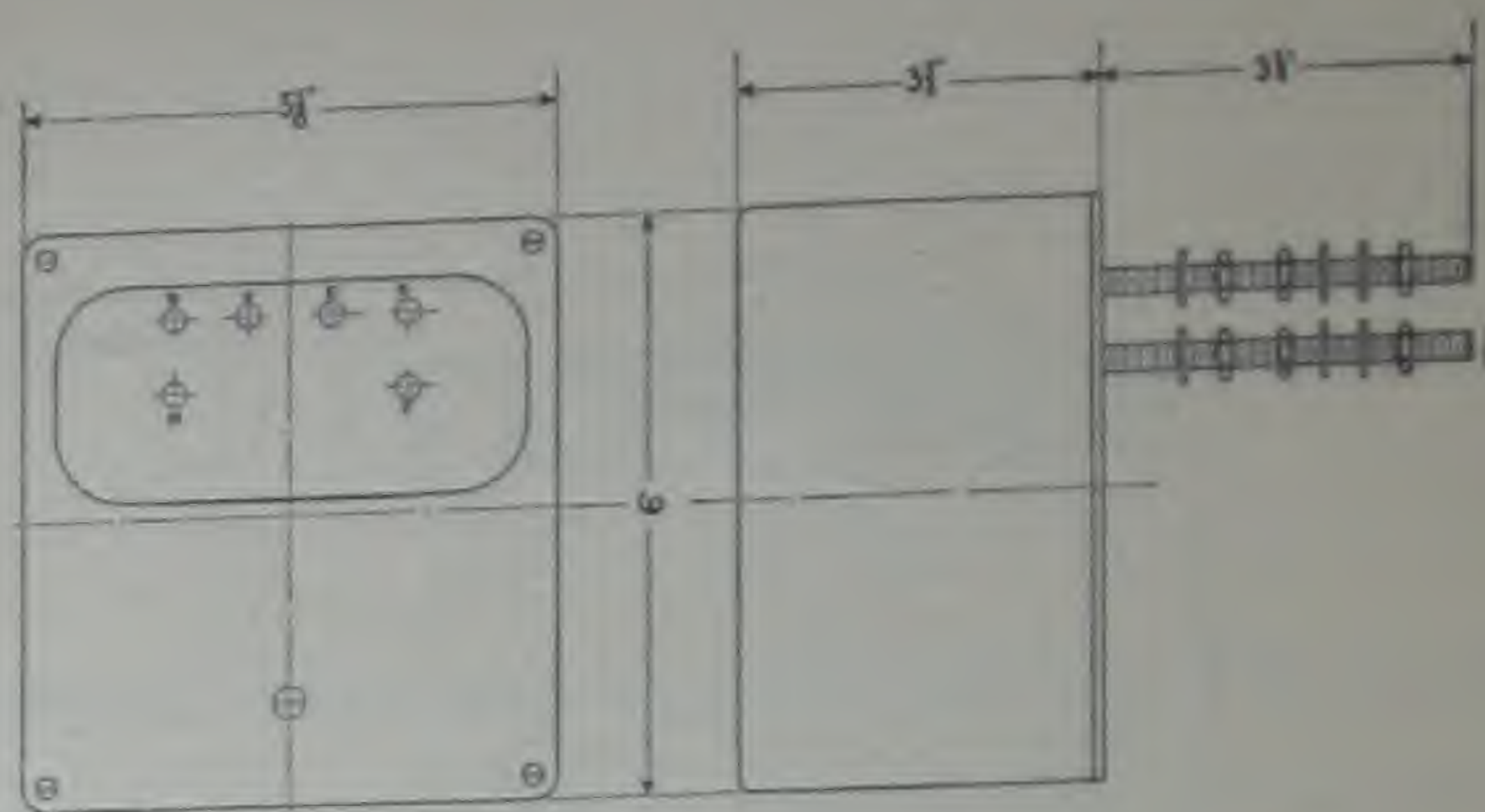


Ammeter, Voltmeter, Frequency Meter—Studs A, B. Single Phase Indicating Wattmeter—Studs A, B, C and D. Power Factor Meter—Studs A, B, C, D, F and H.

**TYPE N A
POLYPHASE
INDICATING
WATTMETER.**
Net Weight,
12 1/2 Lbs.
Shipping Weight
20 Lbs.



ALL DIMENSIONS ARE APPROXIMATE AND FOR REFERENCE PURPOSES ONLY. BLUE PRINTS ON REQUEST.



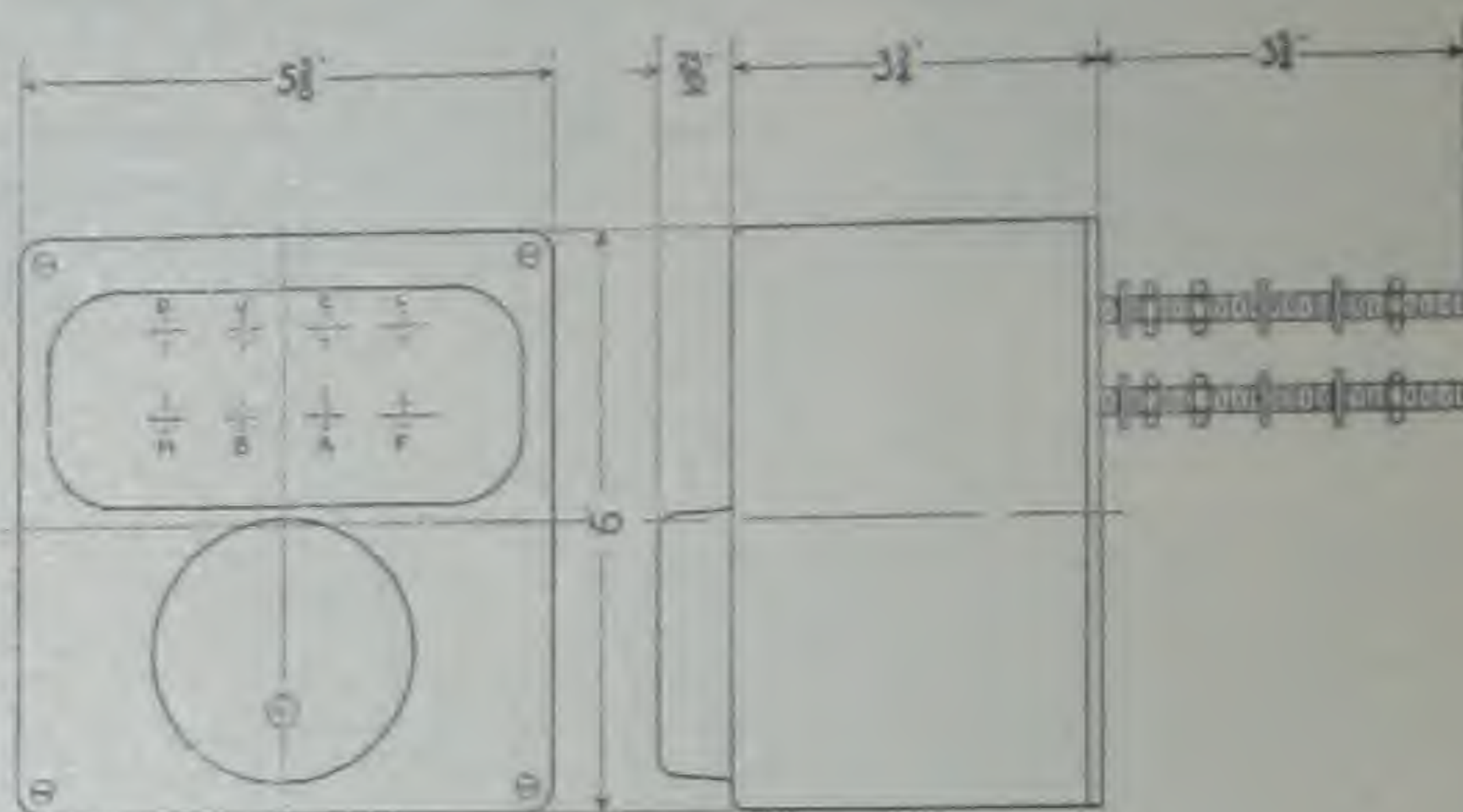
TYPE RA, A. C.

AMMETER, VOLTMETER, SINGLE PHASE INDICATING WATTMETER,
FREQUENCY METER, POWER FACTOR METER

Net Weight, 8 Lbs.

Shipping Weight, 14 Lbs.

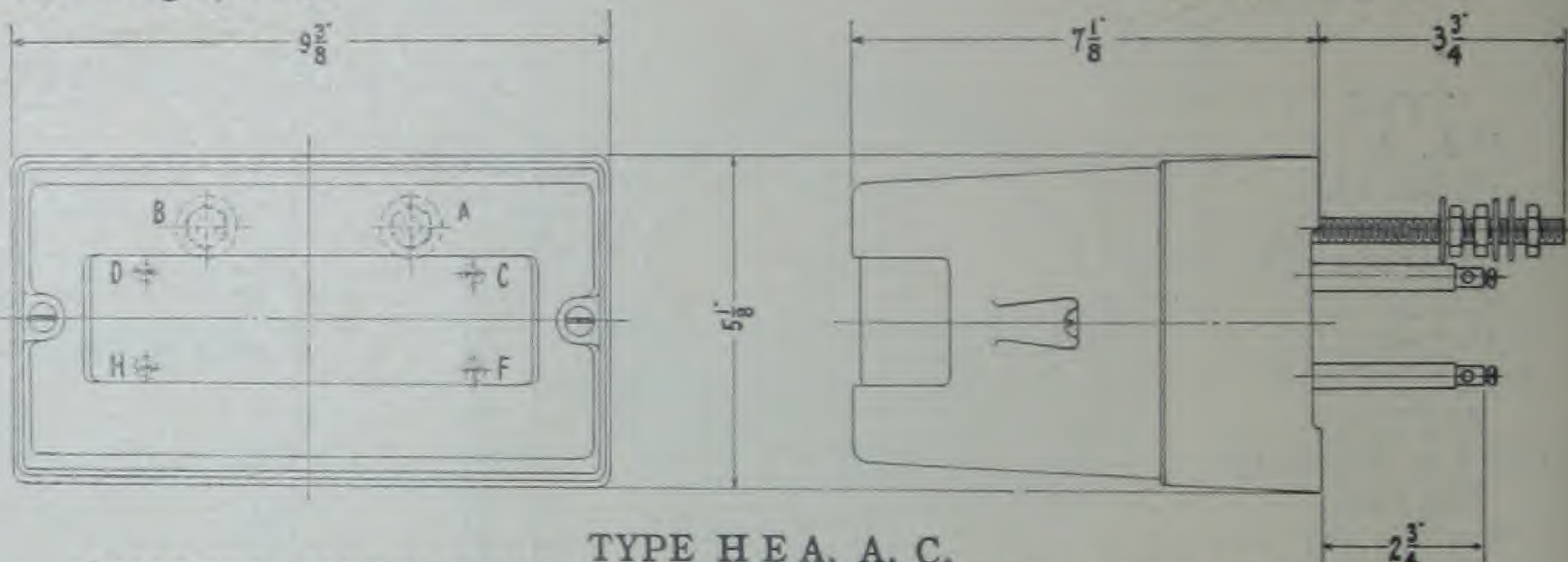
Ammeter, Voltmeter, Frequency Meter, Studs—H, F. Single Phase Indicating
Wattmeter, Studs—D, C, H, F. Power Factor Meter Studs—J, E, C, D, F, H.



TYPE RA
POLYPHASE INDICATING WATTMETER

Net Weight, 9 Lbs.

Shipping Weight, 15 Lbs.



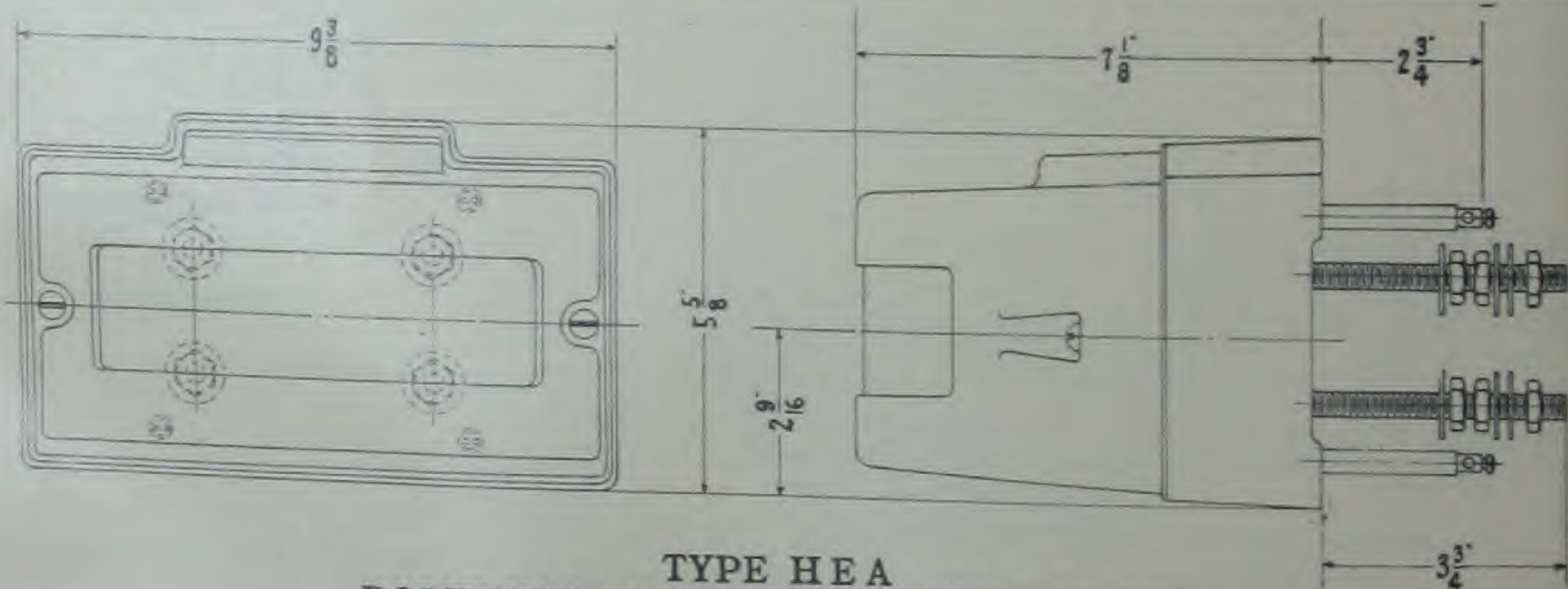
TYPE HEA, A. C.

AMMETER, VOLTMETER, SINGLE PHASE INDICATING WATTMETER,
FREQUENCY METER, POWER FACTOR METER

Net Weight, 15 Lbs.

Shipping Weight, 24 Lbs.

Ammeter, Voltmeter, Frequency Meter Studs—A, B. Single Phase Indicating
Wattmeter, Studs—A, B, H, F. Power Factor Meter Studs—A, B, C, D, F, H.



TYPE HEA
POLYPHASE INDICATING WATTMETER

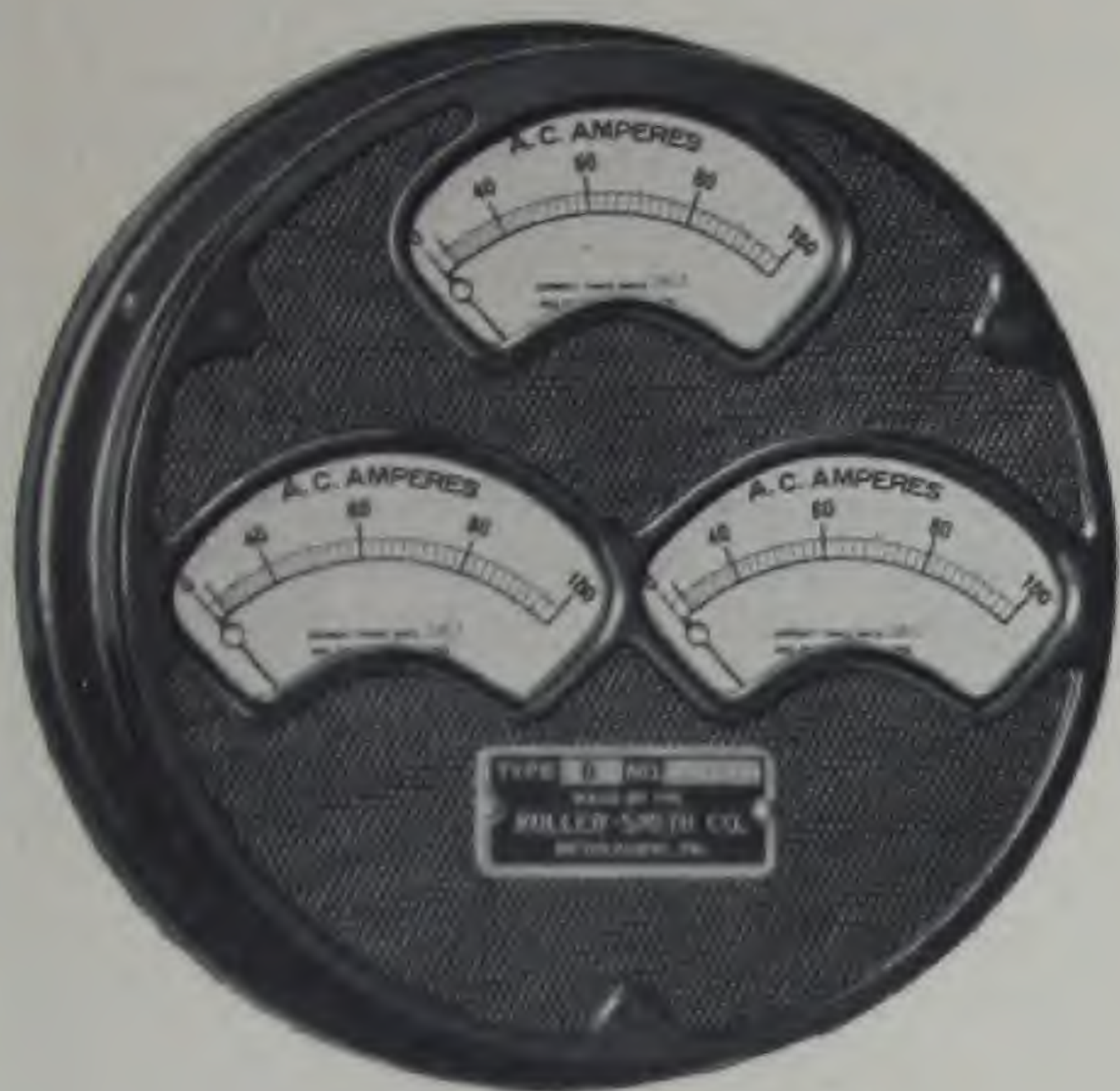
Net Weight, 16 Lbs.

Shipping Weight, 25 Lbs.

ALL DIMENSIONS ARE APPROXIMATE AND FOR REFERENCE
PURPOSES ONLY. BLUE PRINTS ON REQUEST.

TYPE B

Triplex Ammeters for Three Phase A. C. Circuits



of rear studs so arranged that they cannot turn, and a full complement of nuts and washers is supplied. In mounting the instrument it is necessary to drill only the holes for the studs, which studs also serve to hold the instrument in place. The whole structure is **dust, moisture and practically water proof**. Each **scale** is about $2\frac{3}{4}$ inches long. **Dials** are pure white bristol board with prominent black inscriptions, are well lighted and easily read. **Scales** are readable from about 20% to 100% of full scale value. **Springs** are phosphor bronze, well aged to minimize zero shifting. **Glass fronts** are cemented in place.

Average **net weight** per instrument is 4 pounds, 4 ounces; **shipping weight** 8 pounds.

The listing is as follows:

Cat. No.	Description	List Price
300s	Type B Triplex Ammeter, capacity 5 amperes for each mechanism, scales marked to suit transformers.....	\$62.50

"s" indicates stock item.

In ordering, specify catalog number, quantity and scale markings desired.

We are prepared to supply variations of the Triplex instruments such as:

- 2 mechanism "Duplex" ammeters
- 2 and 3 mechanism voltmeters.

Triplex Ammeters in capacities exceeding 5 amperes and less than 5 amperes (self-contained).

See pages 42 and 43 for listing of current transformers.

Correspondence regarding these is invited.

THIS page covers a new type of ammeter developed for one of the largest public utilities in the country. It is used by them for taking simultaneous readings in each of the three phases of a three phase, high tension metering circuit. Three separate ammeter mechanisms, each independent of the others, are mounted in one $7\frac{1}{2}$ -inch case, as shown in the illustration. Each mechanism has a capacity of 5 amperes and its scale is marked according to the ratio of the current transformer to which it is connected.

Details are as follows:

Mechanisms are of the electro-magnet type. An efficient air **damp- ing** scheme is used. All three mechanisms are mounted on the rigid Bakelite base, thus insuring proper insulation and providing against misalignment of parts. In addition, there is a Bakelite barrier between each mechanism. **Overall diameter** is $7\frac{1}{2}$ inches and the depth (not including studs, of which there are six) is $2\frac{5}{16}$ inches. **Case** is pressed steel, light and rigid. **Finish** is dull black rubberoid—the best for long wear. **Connections** are in the form

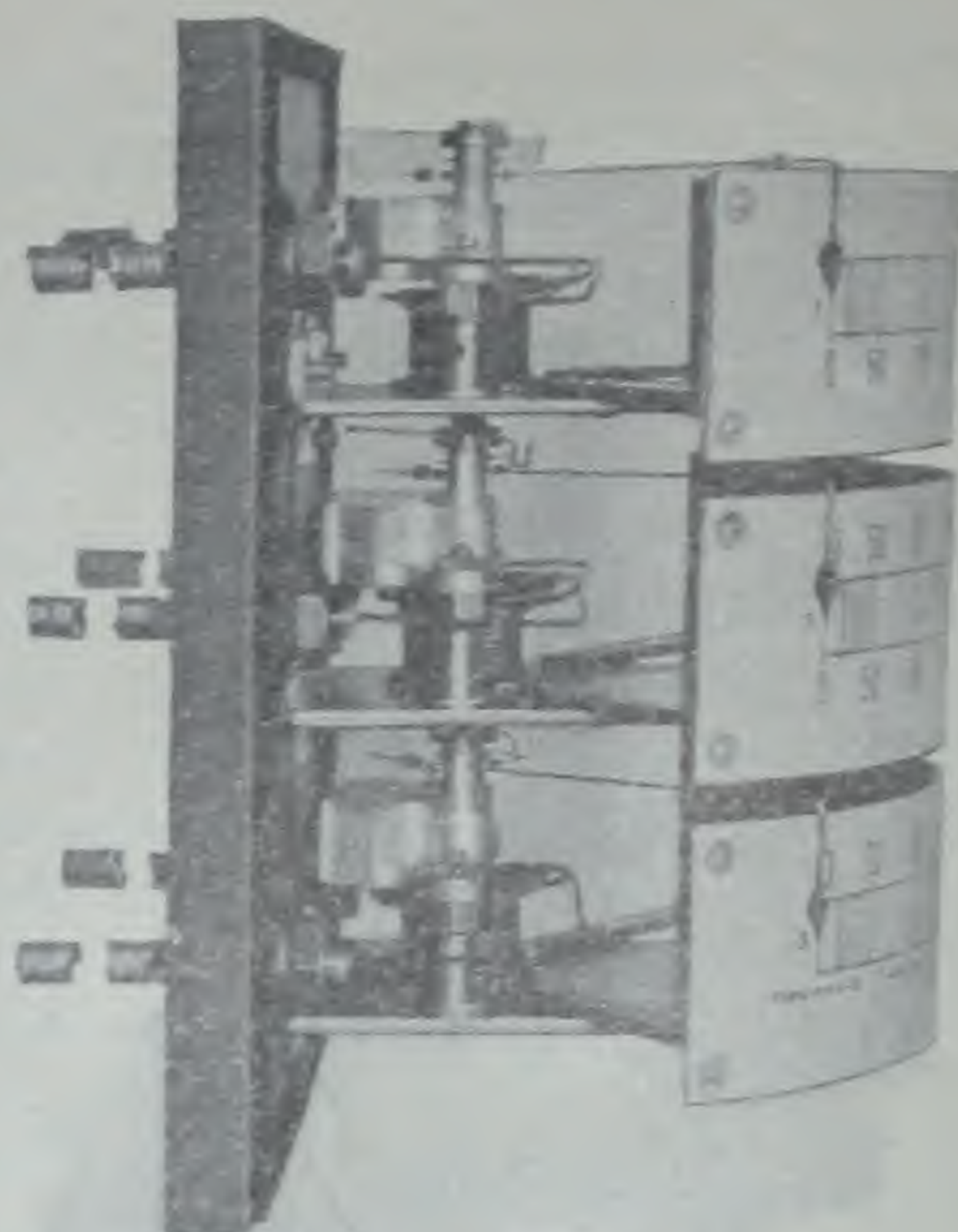
PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

Type HEA-3 Ammeter

For Three Phase Circuits



The Type HEA-3 ammeter is a new three phase ammeter developed for a large public utility to supplement our Type B Triplex three phase ammeter (see page 37), of which a large number are used by them and many other public utility companies. The HEA-3 ammeter is distinguished by its very long scale ($7\frac{1}{8}$ inches) and is most useful when very close readings are desired.

The Type HEA-3 ammeter consists of three horizontal edgewise mechanisms, mounted one above the other in a single case and utilizing one single window. The two outstanding features characterizing this design are as follows:

1. The ease with which accurate comparison can be made of the current in three different phases. For simultaneous readings they cannot be equalled as the slightest difference between the current in the different phases is indicated clearly.

2. The relatively small switch-board area compared with the space occupied by three standard full size horizontal edgewise instruments.

Details are as follows:

The mechanisms are of the standard electro-magnet type, as illustrated on page 22. Damping is obtained through a damping vane rotating a die-cast chamber. The three mechanisms are magnetically shielded from each other, so that there is no mutual interference. The individual scales are the same length as those in the standard type HEA single instrument, namely $7\frac{1}{8}$ " (see page 32). Base dimensions are $8\frac{3}{8}$ " width and $9\frac{5}{8}$ " height and the case projects $29/32$ " from the board. Connections are in the form of three pairs of studs firmly anchored to the base bakelite bushings. For mounting the instrument it is necessary to drill only six holes in the switchboard, the terminal studs act also as supporting studs. The case is finished in dull black rubberoid finish. Dials are pure white bristol board with prominent black inscriptions, are well lighted and easily read. Scales are readable from about 20% to 100% full scale value. The glass front is cemented in place. Accuracy is within $1\frac{1}{4}\%$ of full scale value at any point on the scale.

Average net weight per instrument is 17 pounds, shipping weight 20 pounds.

The listing is as follows:

Cat. No.	DESCRIPTION	List Price
301s	Type HEA-3 ammeter, capacity 5 amperes for each mechanism, scales marked to suit transformers	\$110.

"s" indicates stock item.

In ordering, specify catalog number, quantity and scale markings desired.

We invite correspondence regarding the Type HEA-3 ammeters in capacities other than 5 amperes.

See pages 42 and 43 for listing of current transformers.

Swinging Brackets

Swinging brackets for switchboard types SA, RA, NA and HEA (alternating current) and types SD, RD, ND, HED and IDD (direct current) instruments are furnished in two lengths as listed below:

<u>Cat. No.</u>	<u>Description</u>	<u>List Price</u>
4375s	15-inch Swinging Bracket for angle iron frame attachment.....	\$16.00
4376s	24-inch Swinging Bracket for angle iron frame attachment.....	16.00
4340	15-inch Swinging Bracket for pipe frame attachment.....	21.00
4341	24-inch Swinging Bracket for pipe frame attachment.....	21.00

Indicates stock item.

These brackets are designed for attaching to side or end of switchboard. The type of clamp is used where frames are of angle iron and another type where frames are pipe. Standard finish is black.

In ordering, give type and specifications of instrument, as well as the catalog number of bracket, and state whether switchboard frame is angle iron or pipe.

Y Boxes and Multipliers

Prices on these quoted on application.

A very complete list of current and voltage transformers is listed on pages 42 and 43.

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

TYPES TW, FW AND STW

THERMO-COUPLE AMMETERS AND MILLI-AMMETERS

THE ROLLER-SMITH COMPANY and its predecessor, The Whitney Electrical Instrument Company, were among the pioneers in the development of hot wire instruments and, when wireless telegraphy created a demand for them, the experience previously obtained was invaluable in producing instruments for high frequency measurements. All of the radio frequency ammeters listed may be used on alternating current of any frequency, including radio frequency, and on direct current. All instruments listed are compensated for heating errors. Proper compensation in a thermo-couple form of instrument results in maximum accuracy, quick return of the pointer to zero after the current has been broken and, consequently, avoids continual manipulation of the zero adjuster, which is apt to be the case with the non-compensated type of instrument.

TYPE TW AMMETERS AND MILLI-AMMETERS

(3 1/2" Diameter)



This instrument employs a thermo-couple of maximum efficiency connected to a d'Arsonval form of movement of high sensitivity. All the materials entering into the thermo-couple have been selected after hundreds of tests were made on various materials and the couple materials employed give the highest E.M.F. for a given temperature and, in addition, will not deteriorate under extremes of heat, moisture, salt air or other atmospheric conditions.

Description: Type TW instruments have an overall diameter of 3 1/2", body diameter of 2 3/4" (2 1/4" for flush bakelite case) and depth (not including studs) 1 5/8" for the surface model and 1 1/2" (behind the flange) for the flush model. Net weight is 10 ounces, shipping weight 1 pound. Scale is 2.1" long.

MILLI-AMMETERS

AMMETERS

Cat. No.	Range	Value per Division	List Price	Cat. No.	Range	Value per Division	List Price
8129	0-100 M.A.	2.5 M.A.	\$19.50	8194	0-1 Amp.	.025 Amp.	\$17.50
8187	0-125	5.0	19.50	8195	0-1.5 Amps.	.05	17.50
8188	0-150	5.0	19.50	8197	0-3	.10	17.50
8189	0-200	5.0	19.50	8198	0-5	.20	17.50
8190	0-300	10.0	19.50	8199	0-10	.25	17.50
8191	0-400	10.0	19.50	8110	0-15	.50	17.50
8192	0-500	20.0	19.50	8111	0-20	.50	17.50
8193	0-600	20.0	19.50				

In ordering specify quantity, catalog number and whether surface or flush model.

THERMO-COUPLE AMMETERS AND MILLI-AMMETERS

TYPE FW AMMETERS AND
MILLI-AMMETERS

(4" Diameter)



Type FW, Surface Model

These instruments employ the same thermo-couples and mechanisms similar to the Type TW instruments. The FW instrument is not furnished in a flush model case, however, and is supplied with a surface model metal case only.

Description:

Scale length is $2\frac{3}{4}$ ".

Finish is standard dull black rubberoid.

All instruments are equipped with zero adjusters.

Overall diameter is 4".

Projection from front of board is $1\frac{3}{4}$ ".

Net weight is 17 ounces; shipping weight, 3 lbs.

MILLI-AMMETERS

AMMETERS

Cat. No.	Range	Value per Division	List Price	Cat. No.	Range	Value per Division	List Price
8151	0-100 M.A.	2.0 M.A.	\$29.25	8175	0-1 Amp.	.02 Amp.	\$29.25
8152	0-125	2.5	29.25	8176	0-1.5 Amps.	.025	29.25
8153	0-150	2.5	29.25	8179	0-3	.05	29.25
8154	0-200	5.0	29.25	8181	0-5	.10	29.25
8155	0-300	5.0	29.25	8184	0-10	.20	29.25
8156	0-400	10.0	29.25	8185	0-15	.25	29.25
8157	0-500	10.0	29.25	8186	0-20	.50	29.25
8158	0-800	20.0	29.25				

In ordering specify quantity and catalog number.



Type STW Ammeter (Back connections)

TYPE STW AMMETERS

(7 $\frac{1}{2}$ " Diameter)

These instruments employ thermo-couples similar in design to ones used in the TW and FW sizes, but the mechanisms are of course, larger. Complete compensation for temperature errors is included in the design.

Application: The Type STW instrument is recommended for larger transmitters, including spark, arc, vacuum tube, high frequency generator types, where the antenna current value is 10 amperes or more.

Mechanism: The instrument mechanism itself is of the same high grade d'Arsonval form as built into the Roller-Smith standard D.C. switchboard and portable instruments. Hand-drawn scales plus the efficient compensation employed assure maximum accuracy.

Description: These instruments are supplied in the surface model only, but may be had with either back connections or front connections, as preferred.

Scale length is 5".

Finish is standard dull black rubberoid.

All instruments provided with zero adjusters.

Overall diameter is 7 $\frac{1}{2}$ ".Projection from front of board is 3 $\frac{1}{4}$ ". Net weight is 8 lbs.; shipping weight, 14 lbs.

AMMETERS

Cat. No.	Range	Value per Division	List Price	Cat. No.	Range	Value per Division	List Price
8160	0-10 Amps.	.2 Amp.	\$55.00	8164	0-40	1.0 Amp.	\$55.00
8161	0-15	.5	55.00	8165	0-60	1.0	62.00
8162	0-20	.5	55.00	8166	0-80	2.0 Amps.	75.50
8163	0-30	1.0	55.00	8167	0-100	2.0	82.50

Prices for higher ranges on application.

In ordering specify quantity, catalog number and whether back or front connections.

Instrument Transformers

CURRENT TRANSFORMERS

Type LK

Wound Primary, 25 Volt-amperes, 25 to 60 Cycles
7500 Volts Maximum

Ratio Primary to Secondary	List Price
5/5 Amperes	\$26.50
10/5 "	26.50
15/5 "	26.50
25/5 "	26.50
50/5 "	26.50
75/5 "	26.50
100/5 "	26.50
150/5 "	27.00
200/5 "	27.00
250/5 "	27.00
300/5 "	32.00
400/5 "	34.50

Types K-1, K-2, K-3 and BK

50 Volt-amperes, 25 to 60 Cycles

WOUND PRIMARY				OPEN PRIMARY	
Ratio Primary to Secondary	LIST PRICE			LIST PRICE	
	Type K-1 4500 V. Maximum	Type K2 7500 V. Maximum	Type K-3 15000 V. Maximum	Type B-K 4500 V. Maximum	Type B-K Opening Dimensions
5/5 Amperes	\$34.25	\$51.00	\$68.50		
10/5 "	34.25	51.00	68.50		
15/5 "	34.25	51.00	68.50		
25/5 "	34.25	51.00	68.50		
50/5 "	34.25	51.00	68.50		
75/5 "	34.25	51.00	68.50		
100/5 "	34.25	51.00	68.50		
150/5 "	35.25	52.00	71.50		
200/5 "	37.00	53.75	73.50		
250/5 "	38.25	54.25	74.50		
300/5 "	40.25	56.75	75.50		
400/5 "	42.25	57.25	77.50	\$26.75	3/4" x 2 1/4"
500/5 "	44.00	58.75	78.50	26.75	3/4" x 2 1/4"
600/5 "	48.00	60.50	79.50	26.75	3/4" x 2 1/4"
750/5 "				26.75	3/4" x 2 1/4"
1000/5 "				29.50	1" x 3 1/4"
1250/5 "				29.50	1" x 3 1/4"
1500/5 "				29.50	1" x 3 1/4"
2000/5 "				34.25	1 1/4" x 3 1/4"
2500/5 "				34.25	1 1/4" x 3 1/4"
3000/5 "				39.25	2" x 4 1/4"
4000/5 "				39.25	2" x 4 1/4"
5000/5 "				44.25	2 1/4" x 5 1/4"
6000/5 "				44.25	2 1/4" x 5 1/4"
7500/5 "				58.75	2 1/2" x 5 1/4"
10000/5 "				108.00	2 1/2" x 6 3/4"
12000/5 "				127.25	4 1/2" x 8 1/4"
12500/5 "				147.00	5" x 8 1/4"
15000/5 "				147.00	5" x 8 1/4"
20000/5 "				147.00	6" x 9 1/2"

Instrument Transformers
CURRENT TRANSFORMERS

Types BK-1, BK-2 and BK-3

Open Primary, 50 Volt-amperes, 25 to 60 Cycles
One turn primary, bus-bar furnished

Ratio Primary to Secondary	LIST PRICE					
	Type BK-1 4500 V. Maximum	Type BK-1 Bus Bar Dimensions	Type BK-2 7500 V. Maximum	Type BK-2 Bus Bar Dimensions	Type BK-3 15000 V. Maximum	Type BK-3 Bus Bar Dimensions
750/5 Amperes	51.75	1 1/4" x 2"	66.75	1 1/4" x 2"	84.25	1 1/4" x 2"
1000/5 "	54.75	1 1/4" x 3"	72.75	1 1/4" x 3"	88.25	1 1/4" x 3"
1250/5 "	64.75	1 1/4" x 3"	84.25	1 1/4" x 3"	98.00	1 1/4" x 3"
1500/5 "	64.75	1 1/4" x 3"	84.25	1 1/4" x 3"	98.00	1 1/4" x 3"
2000/5 "	69.50	2 1/4" x 3"	96.00	2 1/4" x 3"	111.00	2 1/4" x 3"

VOLTAGE TRANSFORMERS
Types PS and PD

Ratio Primary to Secondary	LIST PRICE					
	Type PS 60 Cycle 50 V. A.	Type PS 60 Cycle 200 V. A.	Type PS 25 Cycle 50 V. A.	Type PS 25 Cycle 200 V. A.	Type PD 60 Cycle 200 V. A.	Type PD 25 Cycle 200 V. A.
220/110 Volts	\$29.50	\$32.25	\$33.50	\$37.25		
440/100 "	32.25	35.25	39.25	42.25		
550/110 "	34.25	38.00	40.25	44.25		
2200/110 "	37.25	40.75	51.50	56.75		
4400/110 "		61.75		73.50		
6600/110 "		80.50		94.00		
11000/110 "					\$137.00	\$190.00
13200/110 "					146.75	210.25

Delivery on all instrument transformers is FOB Camden, N. J., U. S. A.
Directions for ordering. Specify quantity, type, ratio, frequency and volt-
amperes.

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

ROLLER-SMITH Products comprise complete lines of Electrical Instruments, indicating and graphic, Relays and air and oil Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned (i. e. to the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Sales Offices

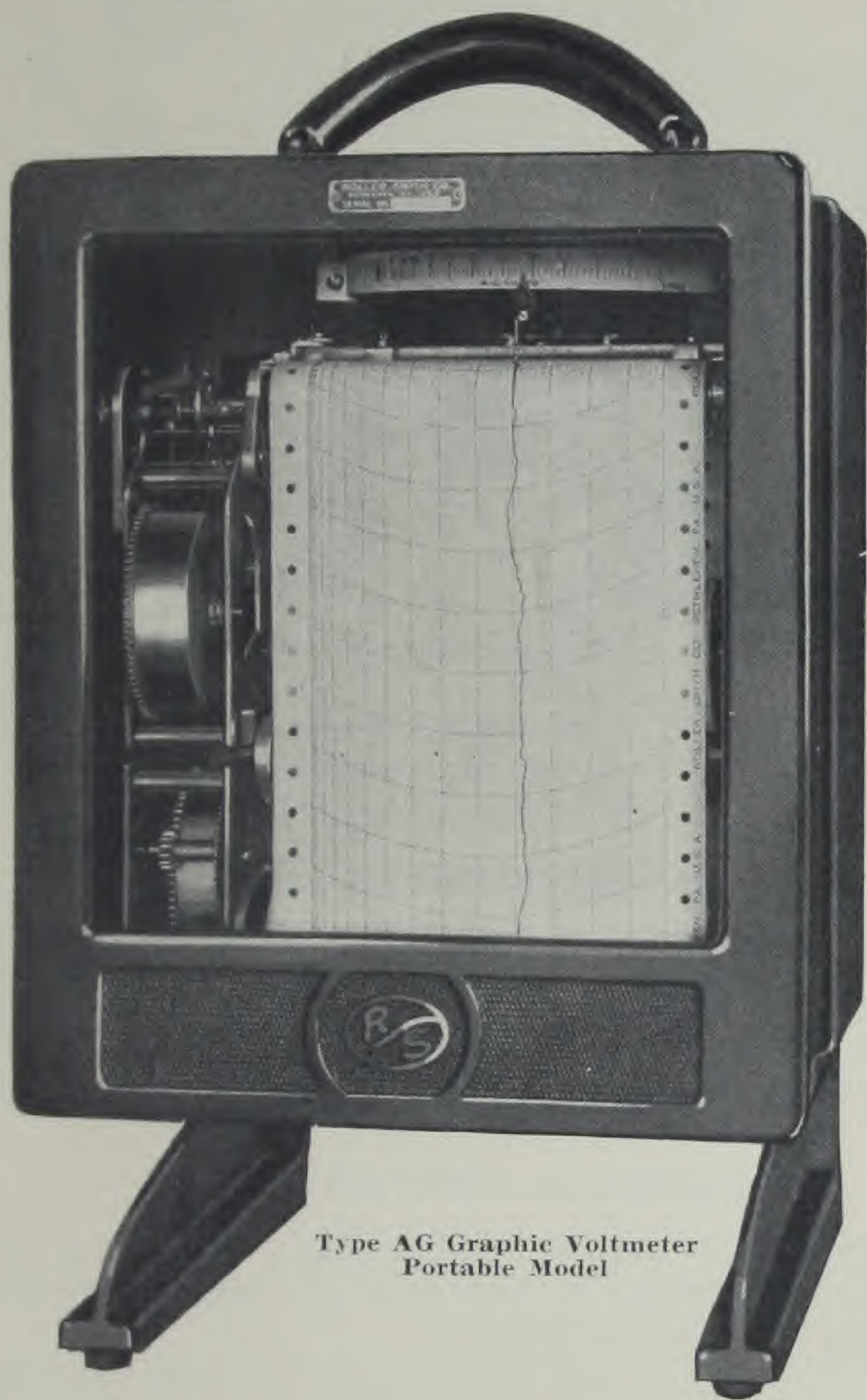
ATLANTA	101 Marietta Street	NEW ORLEANS	Masonic Temple
BOSTON	48 Broad Street	OMAHA	W. O. W. Building
BUFFALO	Ellicott Square Building	PHILADELPHIA	Otis Building
CHICAGO	43 W. Jackson Blvd.	PITTSBURGH	First Nat. Bank Bldg.
CLEVELAND	1541 E. 65th Street	ST. LOUIS	Natl. Bk. of Com. Bldg.
DETROIT	Fisher Building	ST. PAUL	Pioneer Building
HOUSTON	P. O. Box 414	SAN FRANCISCO	163 2nd Street
LOS ANGELES	517 E. Third Street	SEATTLE	Alaska Bldg.
MONTREAL	Tramway Bldg.	TORONTO	187 George Street
NEW YORK	211 Broadway	WINNIPEG	204 Scott Block





BULLETIN NO. 830
APRIL, 1930

GRAPHIC INSTRUMENTS
Type AG for Alternating Current
Type DG for Direct Current
Switchboard, Wall and Portable Types



Type AG Graphic Voltmeter
Portable Model

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



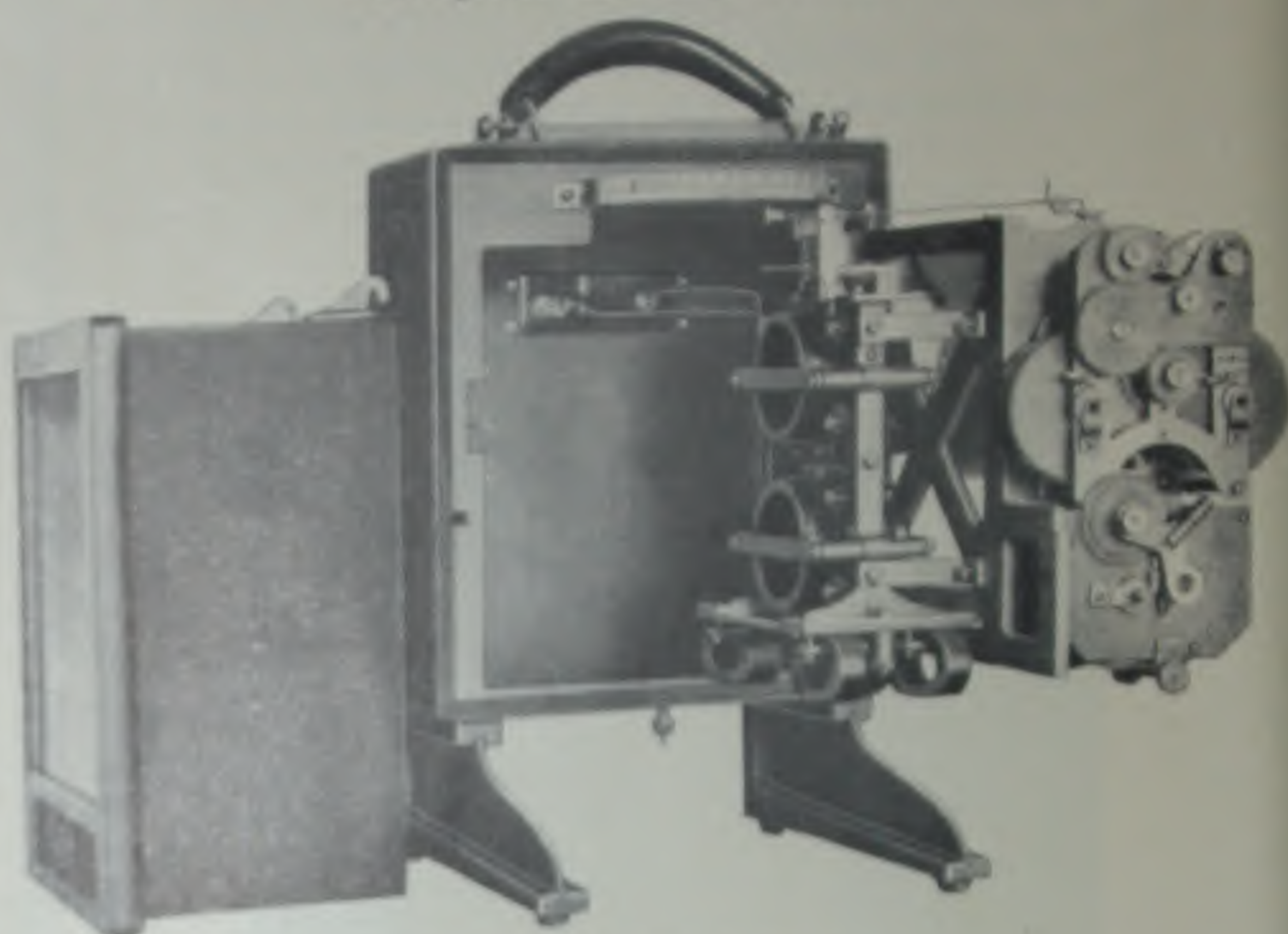
WORKS:
Bethlehem, Pennsylvania
Offices in Principal Cities in United States and Canada
Representatives in Australia, Cuba, Japan and Philippine Islands

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

Graphic Instruments



Type AG Graphic Voltmeter
Portable Model

GENERAL DESCRIPTION

All graphic instruments are furnished regularly with gears for 5 speeds, namely, $3\frac{1}{4}$ ", $11\frac{1}{2}$ ", 3", 6" and 12" per hour. They have the strip type of chart 5" wide with $4\frac{1}{2}$ " scale. Chart is 75 ft. long. Average net weight is 30 lbs., average shipping weight 100 lbs.

GENERAL CONSTRUCTION

Roller-Smith graphic instruments embody a number of unique points in their construction, the outstanding ones being as follows:

The instruments are built into a light but very rigid metal base, the cover of which may be instantly removed, making the insertion of new rolls, the filling of ink well and other adjustments very convenient. To facilitate still further the making of adjustments which must be made when the instrument is in service the clock and chart mechanisms and the electrical mechanism, as well, are mounted on a common sub-base which is hinged on one side of the main base. This sub-base can be unlatched and swung outwards as shown on the ac-

ROLLER-SMITH Graphic Instruments

companying illustration. With the cover removed and the sub-plate swung open the operator can inspect every portion of the electrical and mechanical mechanisms with the greatest facility and without the necessity of getting close to adjacent apparatus, a highly important point to consider in switchboard installations. Alternating and direct current instruments are alike as regards case, base and clock mechanisms, the sub-base being drilled differently to accommodate the various A.C. and D.C. movements.

ELECTRICAL MECHANISMS

The D.C. ammeter and voltmeter mechanism is an exceptionally sturdy, high torque d'Arsonval type of construction. The moving element bearings are extra large size Ceylon sapphire jewels. The A.C. movements are of the dynamometer type of mechanism in which the field windings are mounted on a bakelite form. Highly efficient damping is secured by means of an aluminum disc passing between poles of powerful magnets, the principle used successfully for many years in watt-hour meters. Direct current ammeters are furnished with external shunts which are listed separately on page 7 of this Bulletin. All A.C. ammeters and wattmeters are of 5 amperes capacity and are designed for operation with standard current transformers.

ACCESSORIES

Each instrument is accompanied by a special box containing a liberal supply of ink, an extra pen point, a pen cleaner and a pen filler. A full set of instructions covering the setting up and operation of the instrument accompanies each instrument.

PEN

The pen of the Roller-Smith graphic instrument is exceptional in its construction in that it can be removed from the instrument in two or three seconds time without the aid of tools and without the need of any extraordinary care, a marked distinction to many types of graphics in which the removal of the pen is a difficult and delicate operation which may occupy several minutes of time. The inkwell, likewise, can be removed from its support by a single turn of a lever. It is not necessary, however, to remove the inkwell in order to refill it as a small lid on the top may be pushed aside and the well filled without disturbing the setting of the pen or any other part of the mechanism.

Type AG

ALTERNATING CURRENT GRAPHIC INSTRUMENTS

*AMMETERS

Range	Value per Division	LIST PRICES					
		Switchboard M't'g.		Wall Mounting		Portable Type	
		Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price
5 Ampere Capacity	Scale to Suit Transformer	8300	\$344.00	8301	\$344.00	8302	\$380.00
0-5 Amps.	.1 Amp.	8303	344.00	8304	344.00	8305	380.00

*VOLTMETERS

Range	Value per Division	LIST PRICES					
		Switchboard M't'g.		Wall Mounting		Portable Type	
		Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price
150 Volt Capacity	Scale to Suit Transformer	8310	\$344.00	8311	\$344.00	8312	\$380.00
0-150 Volts	2 Volts	8313	344.00	8314	344.00	8315	380.00
†0-300	4	8316	354.00	8317	354.00	8318	390.00
†0-500	10	8319	360.00	8320	360.00	8321	396.00
†0-600	8	8322	364.00	8323	364.00	8324	400.00
†0-750	10	8325	375.00	8326	375.00	8327	411.00

† Has external resistor.

* For listing of instrument transformers for use with graphic ammeters and voltmeters see Supplement No. 2 to Bulletin No. 450 covering switchboard type transformers. Bulletin No. 160 lists the type ROWD portable current transformer.

Double and triple range Type AG voltmeters can be supplied but ranges must be selected with scale division multiples, such as, for example, 150, 300 and 600 volts. To figure the list price of a multi-range voltmeter add to the list price of the highest voltage range selected \$15.00 list for each additional range.

Directions for Ordering: Specify quantity, catalog number and whether switchboard, wall or portable type. When transformers are to be used with the instruments specify the ratios of the transformers.

Type AG ALTERNATING CURRENT GRAPHIC INSTRUMENTS

*Single Phase and Polyphase Wattmeters

SINGLE PHASE WATTMETERS

Amps.	Volts	Scale	LIST PRICES					
			Switchb'd. M'g.		Wall Mounting		Portable Type	
			Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price
5	100-150	To Suit Transformer	8330	\$344.00	8331	\$344.00	8332	\$380.00
15	200-300	"	8333	354.00	8334	354.00	8335	390.00
15	400-600	"	8336	364.00	8337	364.00	8338	400.00
5	100-150	0-750 Watts	8339	344.00	8340	344.00	8341	380.00
15	200-300	0-1500	8342	354.00	8343	354.00	8344	390.00
15	400-600	0-300	8345	364.00	8346	364.00	8347	400.00

POLYPHASE WATTMETERS

5	100-150	To Suit Transformer	8350	\$344.00	8351	\$344.00	8352	\$380.00
15	200-300	"	8353	354.00	8354	354.00	8355	390.00
15	400-600	"	8356	364.00	8357	364.00	8358	400.00
5	100-150	0-1500 Watts	8359	344.00	8360	344.00	8361	380.00
15	200-300	0-3000	8362	354.00	8363	354.00	8364	390.00
15	400-600	0-6000	8365	364.00	8366	364.00	8367	400.00

*Power Factor Meters

Amps.	Volts	Phases	Wires	LIST PRICES					
				Switchb'd. M'g.		Wall Mounting		Portable Type	
				Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price
5	100-150	3	3	8370	\$344.00	8371	\$344.00	8372	\$380.00
15	200-300	3	3	8373	354.00	8374	354.00	8375	390.00
15	400-600	3	3	8376	364.00	8377	364.00	8378	400.00
5	100-150	2	3	8379	344.00	8380	344.00	8381	380.00
15	200-300	2	3	8382	354.00	8383	354.00	8384	390.00
15	400-600	2	3	8385	364.00	8386	364.00	8387	400.00
5	100-150	2	4	8388	344.00	8389	344.00	8390	380.00
15	200-300	2	4	8391	354.00	8392	354.00	8393	390.00
15	400-600	2	4	8394	364.00	8395	364.00	8396	400.00

† Has external resistor.

All power factor meter scales are .5 Lag-.5 Lead.

* For listing of instrument transformers for use with graphic single phase and polyphase wattmeters and power factor meters see Supplement No. 2 to Bulletin No. 610 covering switchboard type transformers. Bulletin No. 148 lists the Type BOWD portable current transformer.

Double and triple voltage capacity Type AG single phase and polyphase wattmeters and power factor meters can be supplied. To figure the list price of a multi-range instrument add to the list price of the highest voltage capacity selected \$15.00 list for each additional capacity.

Directions for Ordering: Specify quantity, catalog number and whether switchboard, wall or portable types. When transformers are to be used with these instruments specify the ratios of the transformers.

Type DG
DIRECT CURRENT
GRAPHIC INSTRUMENTS
Ammeters, Milli-Voltmeters and Voltmeters

*AMMETERS

Range	Value Per Division	LIST PRICES					
		Switchboard M't'g.		Wall Mounting		Portable Type	
		Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price
100 M. V. Capacity	Scale to Suit Shunt	8400	\$344.00	8401	\$344.00	8402	\$380.00

†MILLI-VOLTMETERS

0-100 M. V.	2 M. V.	8405	\$344.00	8406	\$344.00	8407	\$380.00
0-250	5	8408	344.00	8409	344.00	8410	380.00
0-500	10	8411	344.00	8412	344.00	8413	380.00

†VOLTMETERS

0- 3 Volts	.04 Volts	8420	\$344.00	8421	\$344.00	8422	\$380.00
0- 10	.2	8423	344.00	8424	344.00	8425	380.00
0- 15	.2	8426	344.00	8427	344.00	8428	380.00
0- 50	.1	8429	344.00	8430	344.00	8431	380.00
0- 75	.1	8432	344.00	8433	344.00	8434	380.00
0-100	2 Volts	8435	344.00	8436	344.00	8437	380.00
0-150	2	8438	344.00	8439	344.00	8440	380.00
0-300	4	8441	354.00	8442	354.00	8443	390.00
0-600	8	8444	364.00	8445	364.00	8446	400.00
0-750	10	8447	375.00	8448	375.00	8449	411.00

* Ammeter prices include 6 ft. leads but not shunts. For shunt prices see listings on next page.

† Double and triple range Type DG milli-voltmeters and voltmeters can be supplied. To figure the list price of a multi-range instrument add to the list price of the highest voltage range selected \$15.00 list for each additional range.

Directions for Ordering: Specify quantity, catalog number and whether switchboard, wall or portable types. If ammeters are to be used with shunts not supplied by us specify capacity and drop of shunt.

CHARTS AND INK

When ordering charts the following should always be stated:

- 1. Alternating or direct current.
- 2. Number of major divisions, i.e., 10 or 15 point scale.
- 3. Full scale value.
- 4. Serial number of instrument.
- 5. Kind of instrument, i.e., whether ammeter, voltmeter, wattmeter or power factor meter.

Example: Chart for Cat. No. 8435 voltmeter should be specified: Direct current, 10 point scale, 0-100 volts, serial number (insert number), voltmeter.

CHARTS: \$3.00 list per roll.

INK: \$1.10 list per 4 oz. bottle.

Type DG
100 M. V. SHUNTS

Switchboard Type

Portable Type

Cat. No.	Capacity	List Price	Cat. No.	Capacity	List Price
8460	5 Amps.	\$14.50	8493	5 Amps.	\$16.00
8461	10	14.50	8494	10	16.00
8462	15	14.50	8495	15	16.00
8463	25	14.50	8496	25	16.00
8264	50	14.50	8497	50	16.00
8465	75	14.50	8498	75	16.00
8466	100	18.50	8499	100	21.00
8467	150	20.00	8500	150	22.50
8468	200	24.50	8501	200	27.50
8469	300	29.00	8502	300	32.50
8470	400	34.00	8503	400	37.50
8471	500	42.00	8504	500	50.00
8472	600	49.00	8505	750	66.00
8473	750	58.00	8506	1000	75.00
8474	800	60.00	8507	1200	86.00
8475	1000	67.00	8508	1500	101.50
8476	1200	77.50	8509	2000	120.00
8477	1500	91.50	8510	2500	157.00
8478	2000	110.00	8511	3000	210.00
8479	2500	147.00	8512	4000	260.00
8480	3000	196.00	8513	5000	310.00
8481	4000	245.00			
8482	5000	290.00			

PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS

ROLLER-SMITH Products comprise complete lines of Electrical Instruments, indicating and graphic, Relays and air and oil Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Representatives

Sales Offices

ATLANTA	101 Marietta Street	NEW YORK	233 Broadway
BOSTON	88 Broad Street	NEW ORLEANS	Masonic Temple
BUFFALO	Ellicott Square Building	OMAHA	W. O. W. Building
CHICAGO	53 W. Jackson Blvd.	PHILADELPHIA	Otis Building
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A B R O A D

THRALL ELECTRIC COMPANY	Box 2049, Havana, Cuba
DUVAL TRADING CO.	Kembla Bldgs., Sydney, Australia
ASHIDA ENGINEERING CO.	Daini, Osaka, Japan
MANILA MACHINERY & SUPPLY CO., INC.,	Box 607, Manila, Philippine Islands



PORTABLE
INSTRUMENTS

CIRCUIT
BREAKERS

RELAYS





ELECTRICAL INSTRUMENTS
FOR
SIGNAL SYSTEM
and AUTOMATIC TRAIN CONTROL
TESTING

Type HSD Volt-Ammeters
Type ISD Volt-Ammeters
Type GSA-3 Ammeters
Type GWA Voltmeters
Type HWA Voltmeters

In addition to the various types of instruments for signal system and automatic train control testing listed in Bulletin No. 100 we are now prepared to supply some new combinations of ranges in Types HSD and ISD. The Types GSA-3, GWA and HWA are new types of instruments, having ranges suitable for more recent requirements in the field. The information in this Supplement is, necessarily, somewhat condensed and detailed data will gladly be supplied on application.

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:

233 Broadway, NEW YORK



WORKS:

Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada
Representatives in Australia, Cuba and Japan

DIRECT CURRENT Type ISD VOLT-AMMETERS

This type of instrument will be found illustrated and described on page 3 of Bulletin No. 100. In addition to the combinations of ranges listed on that page the following combination can now be supplied:

Price List

Cat. No.	Ranges	Value per scale Division	List Price
1032	0-3 Volts	.02 Volt	\$115.00
	0-15 "	.1 "	
	0-150 "	1. "	
	0-.3 Amp.	.002 Amp.	
	0-1.5 Amps.	.01 "	
	0-15 "	.1 "	

DIRECT CURRENT Type HSD VOLT-AMMETERS

The Type HSD volt-ammeter is illustrated and fully described on page 4 of Bulletin No. 100. In addition to the combinations of ranges listed on that page the following combination can now be supplied:

Price List

Cat. No.	Ranges	Value per scale Division	List Price
1034	0-3 Volts	.05 Volt	\$47.50
	0-15 "	.1 "	
	0-150 "	2.5 Volts	
	0-.3 Amp.	.005 Amp.	
	0-1.5 Amps.	.025 "	
	0-15 "	.25 "	

ALTERNATING CURRENT
Type GSA-3 AMMETERS

The Type GSA-3 ammeter has the same physical dimensions and the same type of mechanism as the Type GSA instruments listed in Bulletins No. 100 and No. 160. The Type GSA-3 ammeter has three self-contained ranges. It differs from the Type GSA in that it is provided with magnetic shielding and with a switch arranged that, moving the switch from one range to another or to the short-circuit position, the circuit will never be opened. The Type GSA-3 ammeter may be used on 25, 60 or 100 cycles.

The following two combinations of current ranges are available:

Price List

Cat. No.	*Ranges	Value per scale Division	List Price
36	{ 0-.1 Amp. 0-.25 " 0-1. "	{ .001 Amp. .0025 " .01 "	\$70.00
38	{ 0-2 Amps. 0-5 " 0-20 "	{ .002 Amp. .05 " .2 "	70.00

Scale are readable from about 20% to 100% of full scale value.

ALTERNATING CURRENT
Type GWA VOLTMETER

The Type GWA voltmeter has four self-contained ranges and the same physical dimensions, scale length and general appearance as the Type GSA line, illustrated and described in Bulletins No. 100 and No. 160. Mechanism consists of a thermo-couple and permanent magnet "d'Arsonval" form of movement. The Type GWA voltmeter can be used on any commercial frequency, A.C. and on direct current. Resistance is over 20 ohms per volt. The Type GWA voltmeter can be supplied in the following combination of ranges:

Price List

Cat. No.	*Ranges	Value per scale Division	List Price
40	{ 0-.5 Volt 0-2. Volts 0-5. " 0-20 "	{ .005 Volt .02 " .05 " .2 "	\$105.00

Scale are readable from about 20% to 100% of full scale value.

ALTERNATING CURRENT Type HWA VOLTMETERS

The Type HWA voltmeters are similar in dimensions, size, length and general appearance to the Type HTA instruments listed in Bulletins No. 100 and No. 160. Form of mechanical resistance values and the fact that the instrument can be used on any commercial frequency, A.C. and on direct current, are the same as in the case of the Type GWA voltmeters described on the preceding page. The Type HWA voltmeter can be supplied in the following two combinations of ranges:

Price List

Cat. No.	*Ranges	Value per scale Division	List Price
†1042	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-.5</div> <div style="display: inline-block; vertical-align: middle;">Volt</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-2</div> <div style="display: inline-block; vertical-align: middle;">Volts</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-5</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-20</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div> </div>	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">.025</div> <div style="display: inline-block; vertical-align: middle;">Volt</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">.1</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">.25</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">1.</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div>	\$85.00
‡1044	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-1</div> <div style="display: inline-block; vertical-align: middle;">Volt</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-5</div> <div style="display: inline-block; vertical-align: middle;">Volts</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-25</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">0-125</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div>	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">.04</div> <div style="display: inline-block; vertical-align: middle;">Volt</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">.2</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">1.0</div> <div style="display: inline-block; vertical-align: middle;">"</div> </div> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">5.0</div> <div style="display: inline-block; vertical-align: middle;">Volts</div> </div>	90.00

† At an extra list price of \$9.00 the Cat. No. 1042 can be supplied with an external resistor to increase the 20 volt range to 120 volts.

‡ External resistor supplied for the 125 volt range.

* Scales are readable from about 20% to 100% of full scale value.

=====

We will be glad to send on request copies of our Bulletin No. 100 and No. 160 in which will be found detailed data on Roller-Smith instruments for signal system and automatic test control testing.



Supplement No. 2 to
BULLETIN NO. 100
July, 1930.

(Superseding Page 4 of Bulletin
No. 100 dated March, 1928,
and second listing on Page 2 of
Supplement No. 1 to Bulletin
No. 100, dated February, 1929.)

Type PD
DIRECT CURRENT VOLT-AMMETERS
FOR
SIGNAL SYSTEM
and AUTOMATIC TRAIN CONTROL
TESTING



Cat. No. 1088, Type PD Volt-Ammeter
with Selector Switch and Fuse

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania
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CIRCUIT
BREAKERS

RELAYS

Type HTD HEADLIGHT TESTER



HEADLIGHT TESTER

The Type HTD headlight tester consists of a very rugged d'Arsonval mechanism enclosed in a heavy sheet metal case with black enamel finish. The scale is read through a narrow sector shaped opening with extra heavy glass. The terminals consist of three foot rubber covered cables fitted with insulated test clips.

In the single range instrument both cables are permanently attached to the instrument. With double range, one cable can be attached to either of two threaded plug sockets, no push buttons being used.

The scale length is 2.1 inches. Dimensions are $4\frac{1}{2}'' \times 3'' \times 1\frac{1}{2}''$. Average net weight is 2 lbs., shipping weight 3 lbs.

LISTING

Cat. No.	Description	List Price
1097s	Type HTD Headlight Tester, range 0-50 volts, with 3 ft. cables.	\$24.50
1098s	Type HTD Headlight Tester, double range, 0-50 and 0-500 volts, with 3 ft. leads.	28.50

"s" indicates stock item.

Directions for Ordering: Specify quantity and catalog number.

BULLETIN No. 160

August, 1928

(Superseding Bulletin No. 160
dated May, 1927 and Bulletin
No. 150 dated December, 1927.)

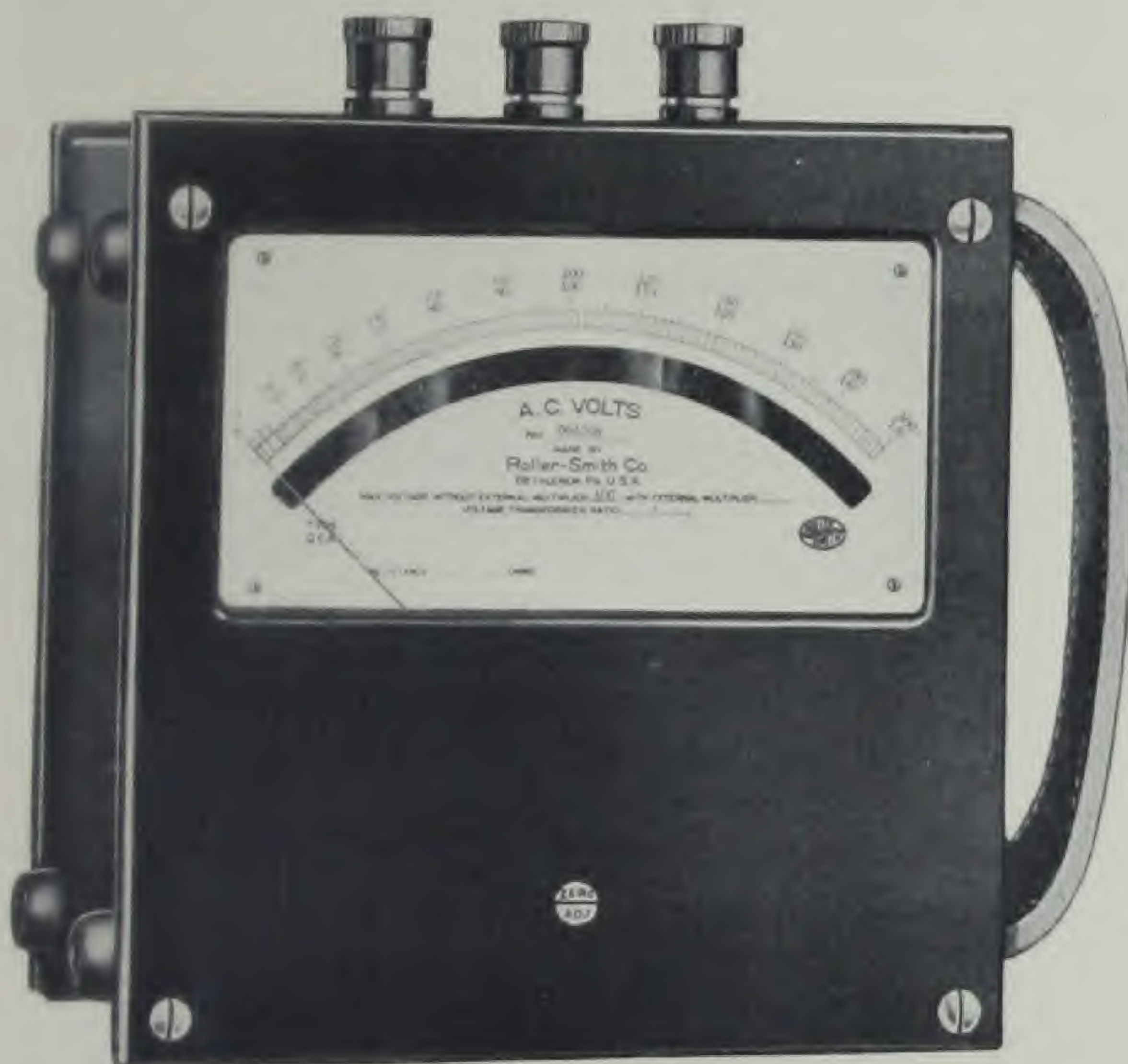


Alternating Current Portable Instruments TYPE GSA

Ammeters, Voltmeters, Volt-Ammeters, Single
and Polyphase Wattmeters, Frequency Meters,
Power Factor Meters, Transformers, Multipliers.

TYPE HTA Ammeters and
Voltmeters

TYPE ISA Volt-Ammeters



ROLLER-SMITH COMPANY

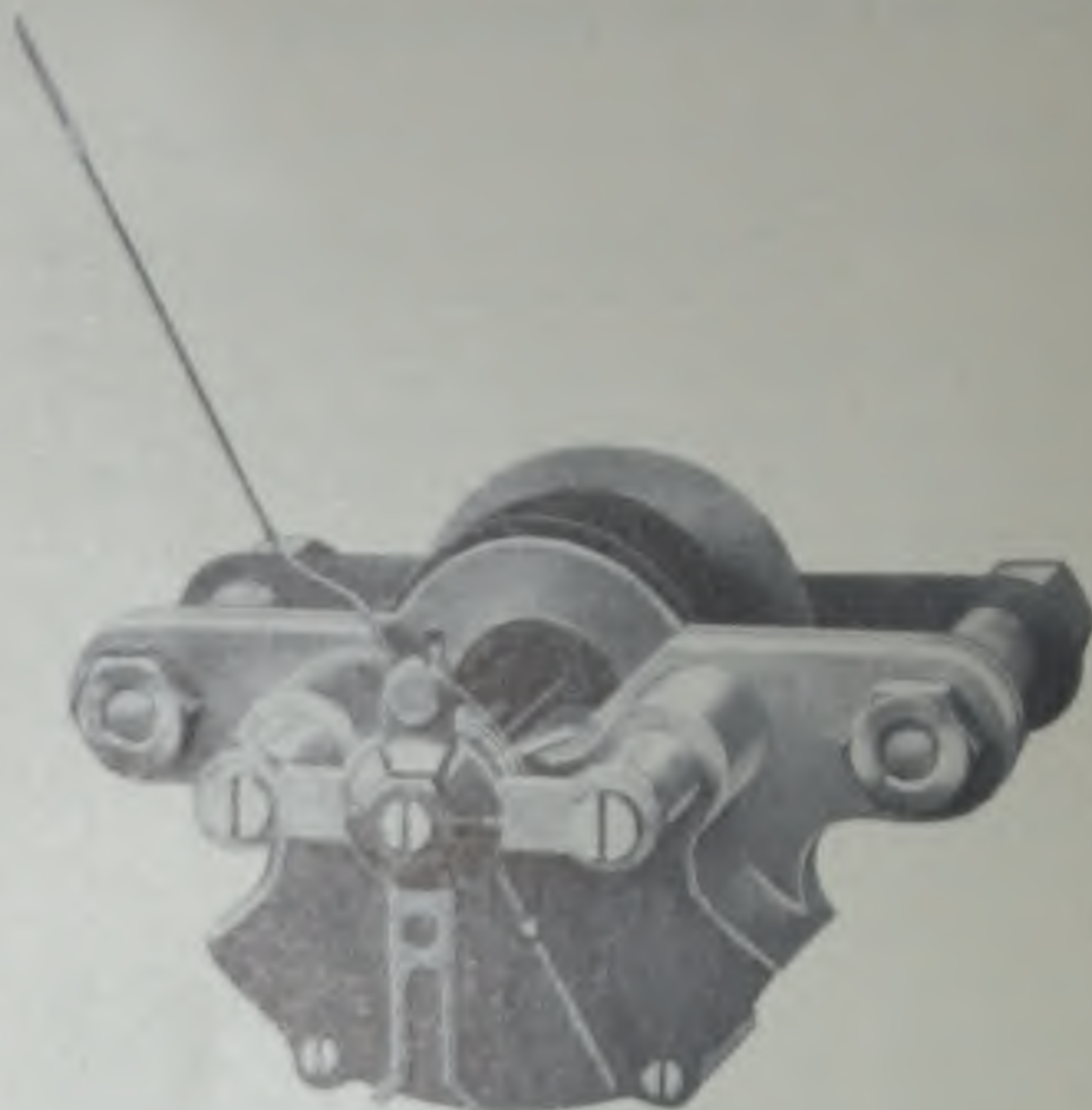
Electrical Measuring and Protective Apparatus

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Bethlehem, Pennsylvania

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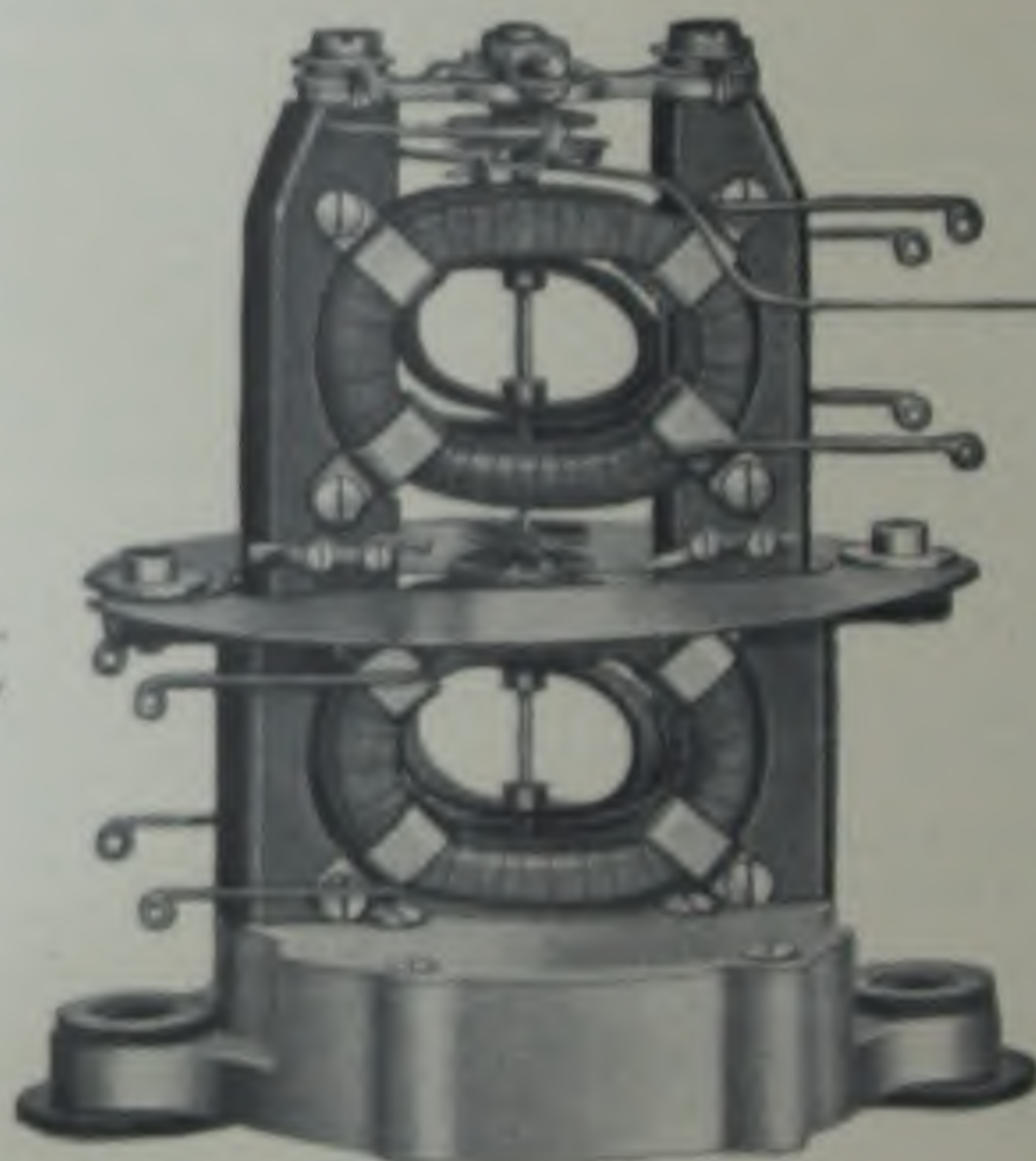
Electro-Magnet-
mechanism used in
Types GSA and HTA
Ammeters and
Voltmeters

(The Type GSA Volt-
Ammeter mechanism is sim-
ilar but has two sets of coils)

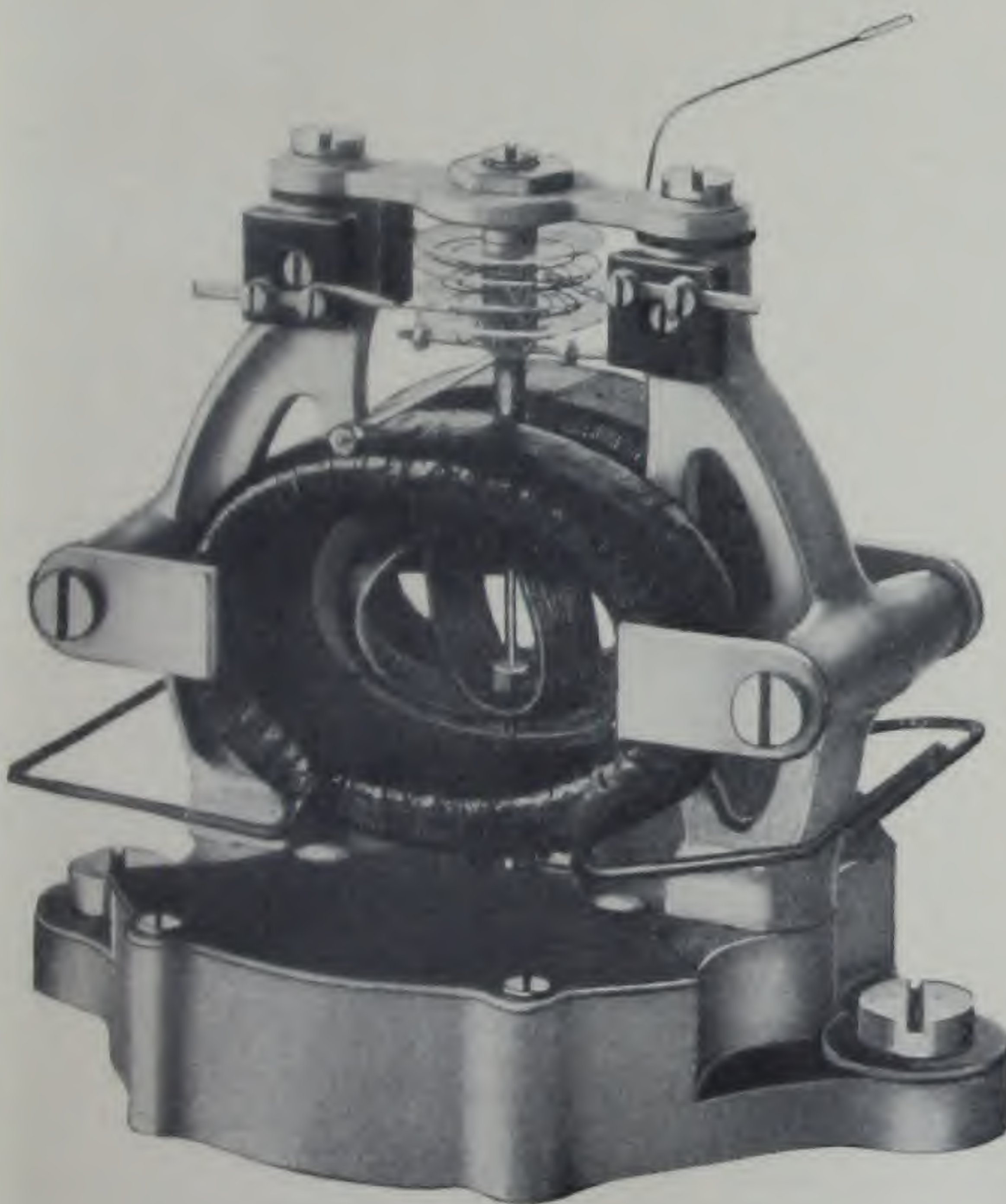
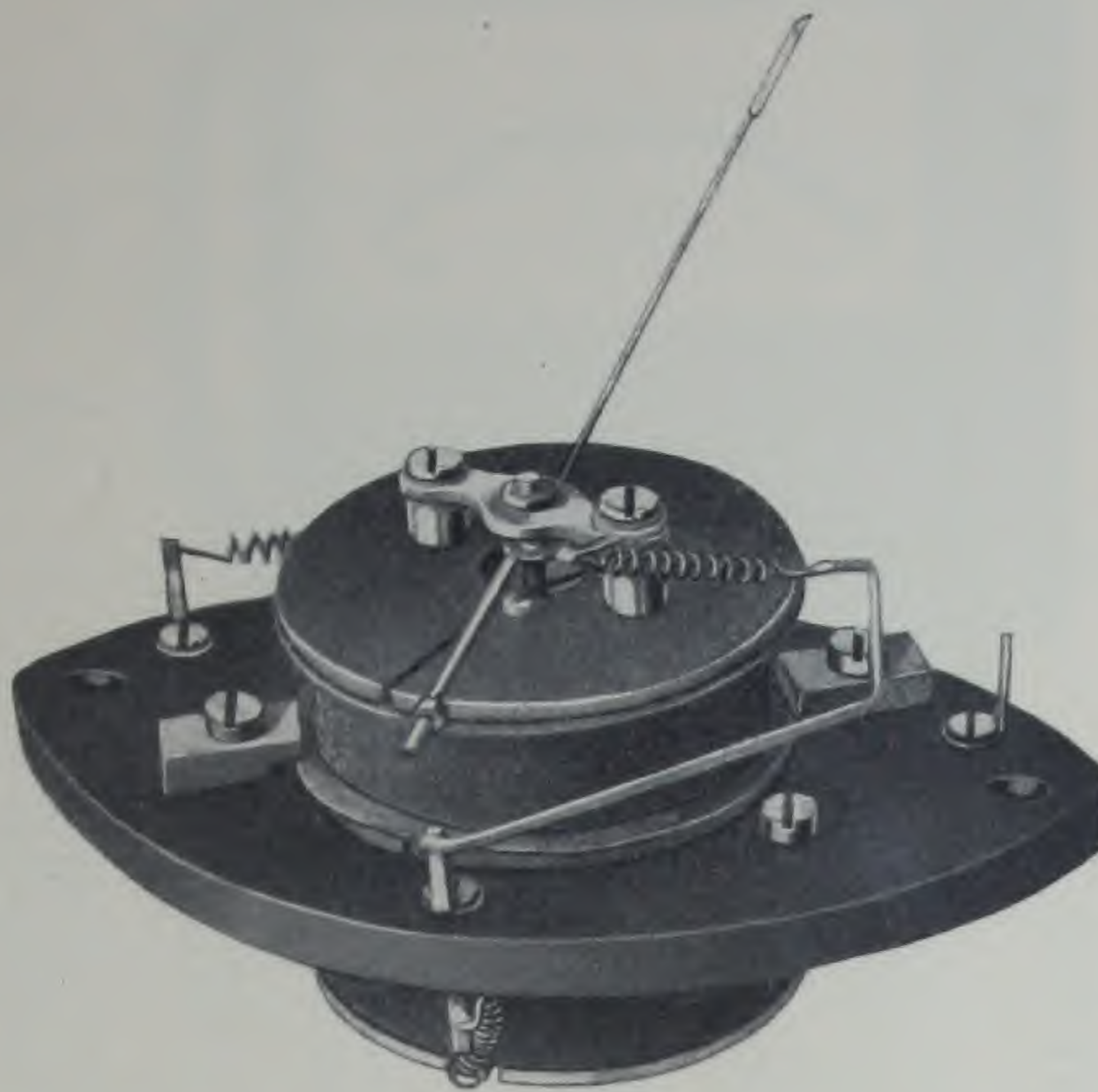
(Type HTA instrumen-
ts have spear head pointers.)

Electro-Dynamometer
mechanism used
in Type GSA
Polyphase Wattmeters

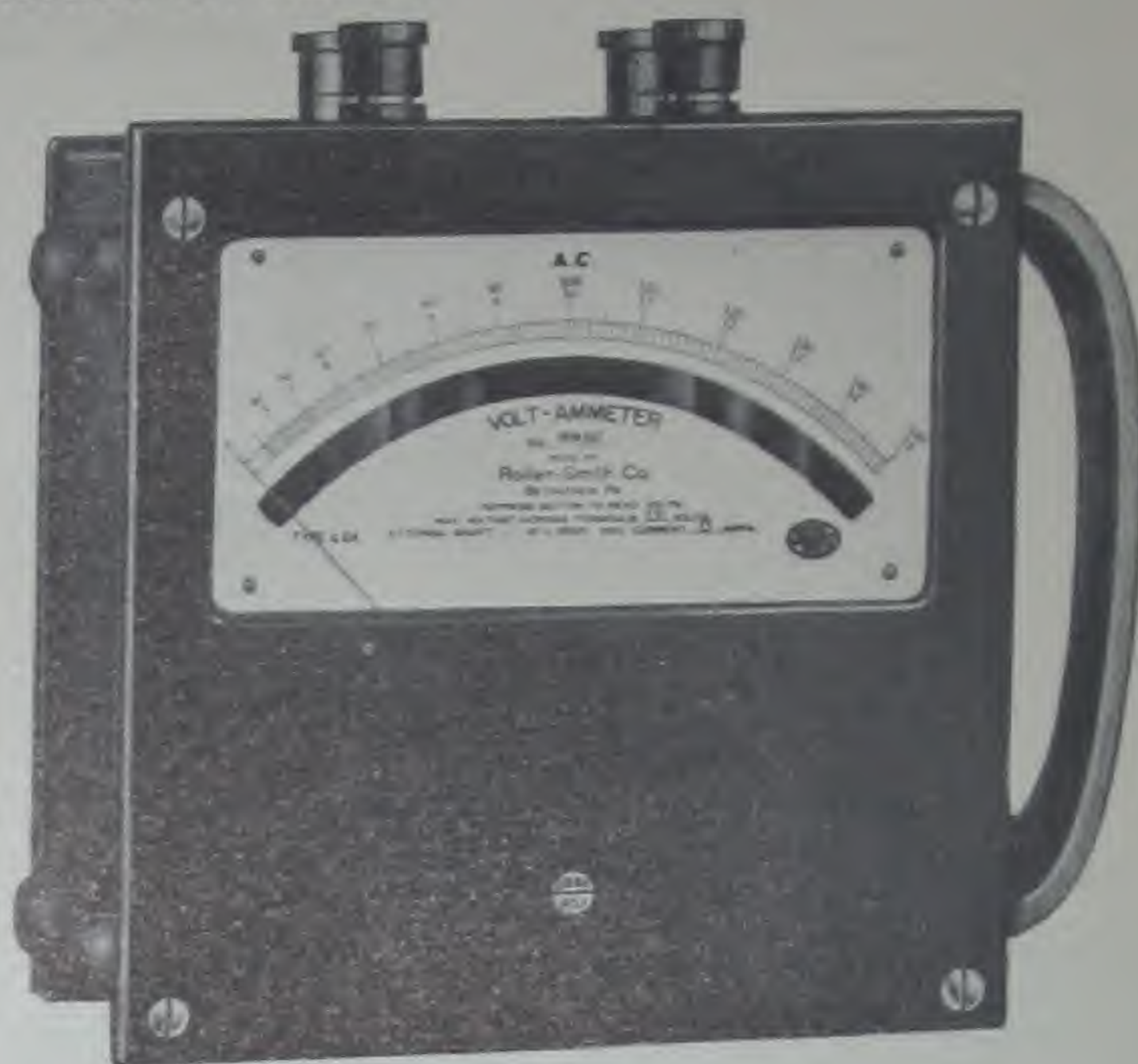
(The single phase mechan-
ism is similar but has only
one set of coils.)



Mechanism
used in Type GSA
Frequency Meters



Electro-Dynamometer
mechanism used
in Type GSA
Power Factor Meters



Alternating Current Portable Instruments TYPE GSA Ammeters and Voltmeters

†Ammeters and Milli-Ammeters

Cat. No.	†Range	Value per Division	List Price
1638s	Capacity 5 amps.	Scale to suit transformer	\$39.00
1600	0-100 M.A.	1. M.A.	41.00
1601	0-250	2.	41.00
1602	0-500	5.	41.00
1603	0-750	5.	41.00
1604	0-1 Amp.	.01 Amp.	41.00
1644	0-1 5 Amps.	.01	41.00
1645	0-3	.02	41.00
1605s	0-5	.05	39.00
1606s	0-10	1.	39.00
1607	0-15	1.	39.00
1608s	0-25	2.	39.00
1609s	0-50	5.	40.00
1610	0-75	5.	40.00
1611s	0-100	1.	40.00
1635s	0-150	1.	42.00
1612s	0-200	2. Amps.	42.00
1613s	0-300	2.	43.50
1662	0-100 M.A.	1. M.A.	82.00
	0-500	5.	
	0-200 M.A.	2. M.A.	82.00
1663	0-1 Amp.	.01 Amp.	
	0-300 M.A.	2. M.A.	82.00
1664	0-1 5 Amps.	.01 Amp.	
	0-750 M.A.	5. M.A.	82.00
1665	0-3 Amps.	.02 Amp.	
	0-1 Amp.	.01 Amp.	80.00
1666	0-5 Amps.	.05	
	0-1 5	.01	80.00
1667	0-7 5	.05	
	0-2	.02	80.00
1668	0-10	1.	
	0-3	.02	80.00
1669	0-15	1.	
	0-5	.05	78.00
1670	0-25	2.	
	0-10	1.	79.00
1671	0-50	5.	
	0-15	1.	79.00
1672	0-7 5	5.	
	0-20	2.	79.00
1673	0-100	1.	
	0-30	2.	82.00
1674	0-150	1.	
	0-50	5.	82.00
1648	0-200	2. Amps.	
	0-75	5 Amp.	83.50
1649	0-300	2. Amps.	

†Voltmeters

Cat. No.	†Range	Value per Division	List Price
1625	Capacity 150 Volts	Scale as selected	\$43.00
1633	0-10 Volts	.1 Volt	42.00
1640	0-15	1.	42.00
1614	0-30	2.	42.00
1615	0-50	5.	42.00
1616	0-75	5.	42.00
1646	0-100	1.	43.00
1617s	0-150	1.	43.00
1618s	0-300	2. Volts	50.00
1619s	0-500	5.	58.50
1620s	0-600	5.	60.50
1647	0-750	5.	63.50
	0-10	.1	84.00
1688	0-50	.5	
	0-15	1.	84.00
1689	0-75	.5	
	0-20	2.	85.00
1690	0-100	1.	
	0-30	2.	85.00
1621	0-150	1.	
	0-75	.5	60.00
1628	0-300	2.	
	0-100	1.	68.50
1691	0-500	5.	
	0-120	1.	70.50
1692	0-600	5.	
	0-150	1.	60.50
1622s	0-300	2.	
	0-150	1.	73.50
1694	0-750	5.	
	0-300	2.	71.25
1623s	0-600	5.	
	0-150	1.	81.50
1624s	0-300	2.	
	0-600	4.	83.50
1626	0-150	1.	
	0-300	2.	
	0-750	5.	

Voltmeters with ranges over 750 volts require external voltage transformer. Data on application.

For non-listed two, three or four range voltmeters, whose **lowest range is in excess of 50 volts** add to the list price of the **highest range** selected, \$10.00 for each additional range.

For non-listed **two range** voltmeters whose **lower range is 50 volts or under** add together the list prices of the two single range instruments selected. Note that only ranges with the same number of scale divisions can be combined.

"s" Indicates stock item.

†Scales are readable from about 20% to 100% of full scale value.

For **ammeters with ranges higher than 300 amperes**, add to the price of Cat. No. 1638, 5 ampere ammeter the price of the appropriate current transformer.

Ammeters ordinarily supplied as series devices (300 amperes and under), can be furnished as 5 ampere devices for use with current transformers, prices being figured as in preceding paragraph. This combination should **always** be used where the line voltage exceeds 750 volts.

See page 14 for listing of transformers.

IN ORDERING, specify quantity, catalog number, special features, if any, and transformer ratios where instruments are used with external transformers.

Alternating Current Portable Instruments

TYPE GSA Volt-Ammeters

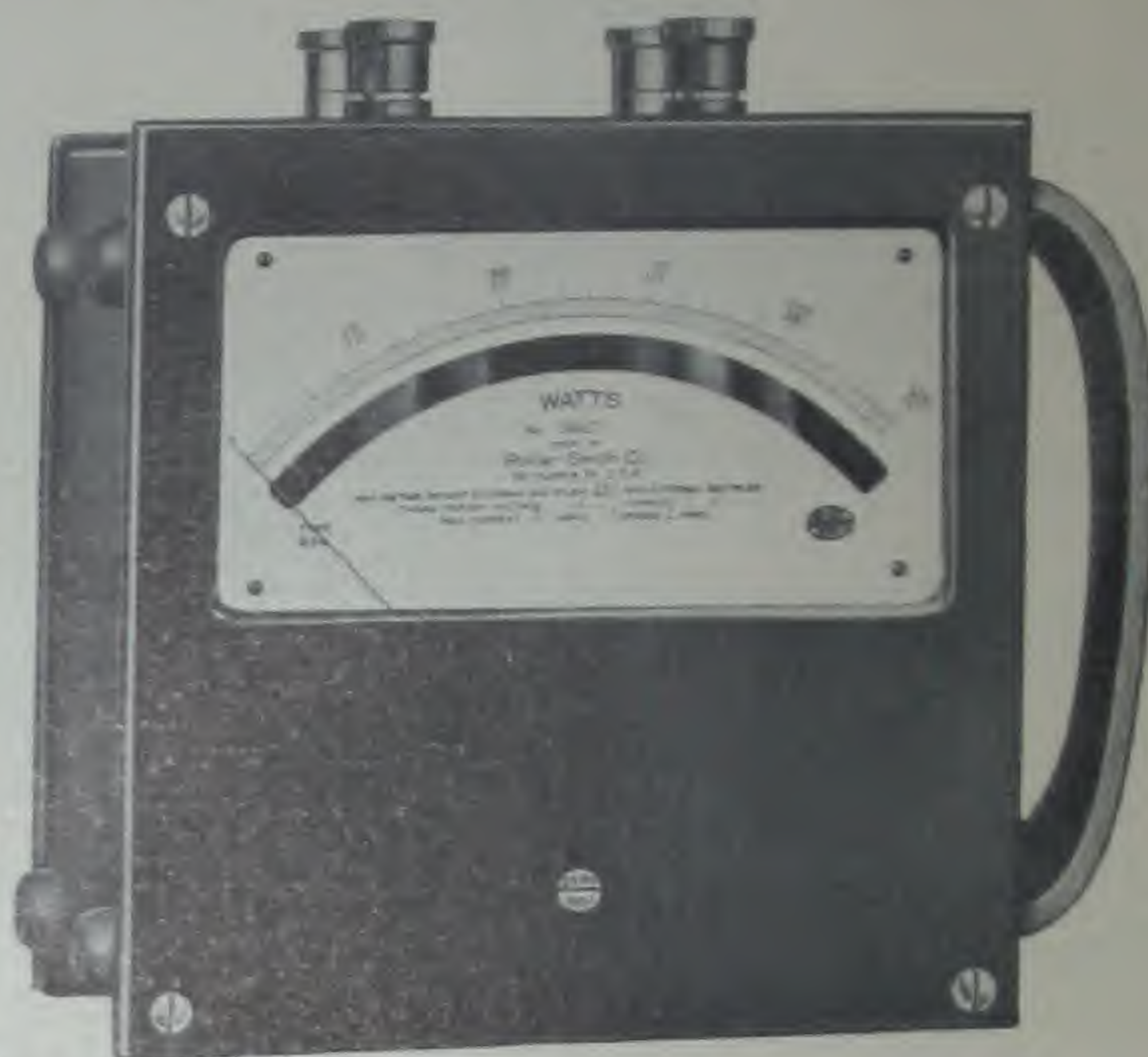
An illustration of the Type GSA Volt-Ammeter is shown on page 6.

*Italic figures denote catalog numbers
+ RANGE IN AMPERES*

RANGE IN VOLTS	0-100 M. A.	0-250	0-500	0-750	0-1 Amp.	0-1.5	0-3	0-5	0-10	0-15	0-25	0-50	0-75	0-100	0-150	0-200	0-300
Volts																	
0-10	83.00 1037	83.00 1745	83.00 1711	83.00 1705	83.00 1770	83.00 1787	83.00 1798	81.00 1840	81.00 1863	81.00 1874	81.00 1894	82.00 1943	82.00 1956	82.00 1967	84.00 1979	84.00 1990	85.50 1998
0-15	83.00 1030	83.00 1744	83.00 1710	83.00 1704	83.00 1770	83.00 1786	83.00 1797	81.00 1840	81.00 1862	81.00 1873	81.00 1893	82.00 1942	82.00 1955	82.00 1966	84.00 1978	84.00 1989	85.50 1997
0-30	83.00 1030	83.00 1744	83.00 1710	83.00 1704	83.00 1770	83.00 1786	83.00 1797	81.00 1840	81.00 1862	81.00 1873	81.00 1893	82.00 1942	82.00 1955	82.00 1966	84.00 1978	84.00 1989	85.50 1997
0-50	83.00 1030	83.00 1744	83.00 1710	83.00 1704	83.00 1770	83.00 1786	83.00 1797	81.00 1840	81.00 1862	81.00 1873	81.00 1893	82.00 1942	82.00 1955	82.00 1966	84.00 1978	84.00 1989	85.50 1997
0-75	83.00 1030	83.00 1744	83.00 1710	83.00 1704	83.00 1770	83.00 1786	83.00 1797	81.00 1840	81.00 1862	81.00 1873	81.00 1893	82.00 1942	82.00 1955	82.00 1966	84.00 1978	84.00 1989	85.50 1997
0-100	84.00 1030	84.00 1745	84.00 1711	84.00 1705	84.00 1770	84.00 1787	84.00 1798	82.00 1840	82.00 1863	82.00 1874	82.00 1894	83.00 1943	83.00 1956	83.00 1967	85.00 1979	85.00 1990	86.50 1998
0-150	84.00 1030	84.00 1745	84.00 1711	84.00 1705	84.00 1770	84.00 1787	84.00 1798	82.00 1840	82.00 1863	82.00 1874	82.00 1894	83.00 1943	83.00 1956	83.00 1967	85.00 1979	85.00 1990	86.50 1998
0-200	91.00 1720	91.00 1740	91.00 1705	91.00 1700	91.00 1770	91.00 1786	91.00 1797	89.00 1840	89.00 1862	89.00 1873	89.00 1893	90.00 1942	90.00 1955	90.00 1966	92.00 1978	92.00 1989	93.50 1997
0-300	99.50 1740	99.50 1740	99.50 1705	99.50 1700	99.50 1770	99.50 1786	99.50 1797	97.50 1840	97.50 1862	97.50 1873	97.50 1893	98.50 1942	98.50 1955	98.50 1966	100.50 1978	100.50 1989	102.00 1997
0-400	103.50 1740	103.50 1740	103.50 1705	103.50 1700	103.50 1770	103.50 1786	103.50 1797	99.50 1840	99.50 1862	99.50 1873	99.50 1893	100.50 1942	100.50 1955	100.50 1966	102.50 1978	102.50 1989	104.00 1997
0-750	104.50 1740	104.50 1740	104.50 1705	104.50 1700	104.50 1770	104.50 1786	104.50 1797	102.50 1840	102.50 1862	102.50 1873	102.50 1893	103.50 1942	103.50 1955	103.50 1966	105.50 1978	105.50 1989	107.00 1997

These are portable instruments which have up to four voltage ranges, having the same number of scale divisions and be supplied at a 100 volt or 115 volt but each additional range is in the form of the voltage range to be used. For example, a 100 volt instrument supplying only to those cases where the lowest voltage range is in excess of 50 volts. For example, a 100 volt instrument, ranges 0-100, 0-150, 0-200, 0-300, 0-400, 0-750, 0-1000, 0-1500, 0-2000, 0-3000, 0-4000, 0-7500, 0-10000, 0-15000, 0-20000, 0-30000, 0-40000, 0-75000, 0-100000, 0-150000, 0-200000, 0-300000, 0-400000, 0-750000, 0-1000000, 0-1500000, 0-2000000, 0-3000000, 0-4000000, 0-7500000, 0-10000000, 0-15000000, 0-20000000, 0-30000000, 0-40000000, 0-75000000, 0-100000000, 0-150000000, 0-200000000, 0-300000000, 0-400000000, 0-750000000, 0-1000000000, 0-1500000000, 0-2000000000, 0-3000000000, 0-4000000000, 0-7500000000, 0-10000000000, 0-15000000000, 0-20000000000, 0-30000000000, 0-40000000000, 0-75000000000, 0-100000000000, 0-150000000000, 0-200000000000, 0-300000000000, 0-400000000000, 0-750000000000, 0-1000000000000, 0-1500000000000, 0-2000000000000, 0-3000000000000, 0-4000000000000, 0-7500000000000, 0-10000000000000, 0-15000000000000, 0-20000000000000, 0-30000000000000, 0-40000000000000, 0-75000000000000, 0-100000000000000, 0-150000000000000, 0-200000000000000, 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Alternating Current Portable Instruments TYPE GSA Single and Polyphase Wattmeters



SINGLE PHASE WATTMETERS

Cat. No.	Amperes	Volts	†Scale	List Price	Cat. No.	Amperes	Volts	†Scale	List Price
1800	1	100-150	0-125 Watts	\$92.50	1809	15	100-150	0-2 K.W.	\$92.50
1801	1	200-300	0-250 "	100.00	1810	15	200-300	0-4 "	100.00
1802	1	400-600	0-500 "	115.00	1811	15	400-600	0-7.5 "	115.00
1822s	5	100-150	To Suit Trans.	92.50	1812	25	100-150	0-3 "	92.50
1823s	5	200-300	"	100.00	1813	25	200-300	0-6 "	100.00
1824s	5	400-600	"	115.00	1814	25	400-600	0-12.5 "	115.00
1803s	5	100-150	0-600 Watts	92.50	1815	50	100-150	0-6 "	92.50
1804s	5	200-300	0-1.25 K.W.	100.00	1816	50	200-300	0-12.5 "	100.00
1805s	5	400-600	0-2.5 "	115.00	1817	50	400-600	0-25 "	115.00
1806	10	100-150	0-1.25 "	92.50					
1807	10	200-300	0-2.5 "	100.00					
1808	10	400-600	0-5 "	115.00					

POLYPHASE WATTMETERS

Cat. No.	Amperes	Volts	†Scale	List Price	Cat. No.	Amperes	Volts	†Scale	List Price
1828s	5	100-150	To Suit Trans.	\$130.00	1825s	5	100-150	0-1.25 K.W.	\$130.00
1829s	5	200-300	"	140.00	1826s	5	200-300	0-2.5 "	140.00
1830	5	400-600	"	155.00	1827	5	400-600	0-5 "	155.00

"s" indicates stock item.

†Scales are readable throughout their entire length and the scale divisions are practically uniform.

For wattmeters with ampere capacities higher than those listed use 5 ampere instruments with external current transformers.

For wattmeters with voltage capacities higher than those listed use external voltage and current transformers.

Indicating wattmeters for use with transformers are calibrated for such use without extra charge. The resulting scales, of course, depend on the transformer ratios involved but are in proportion to those listed on this sheet. See page 14 for listing of transformers.

For wattmeters with two or three voltage capacities add to list price of highest voltage capacity involved \$10.00 for single phase and \$15.00 for polyphase for each added capacity.

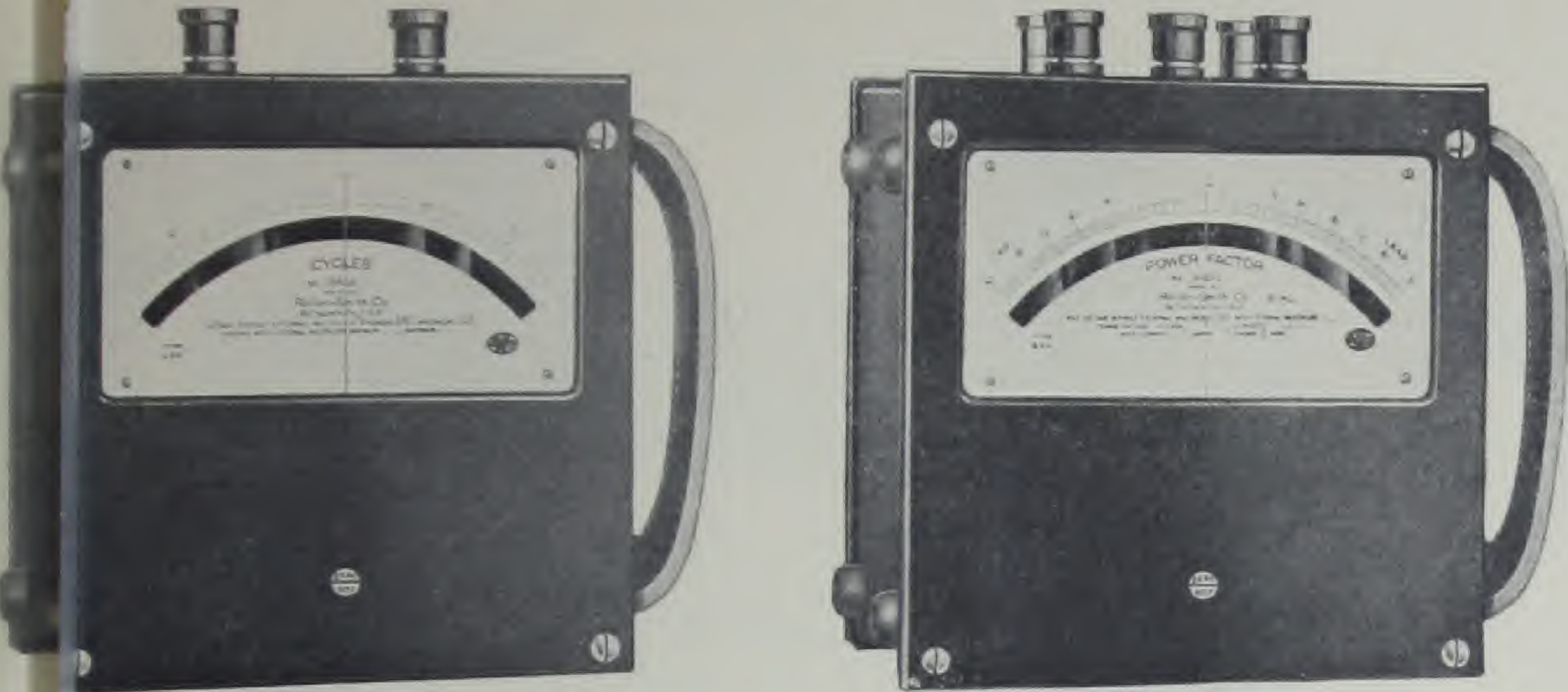
Double current capacity single phase and polyphase wattmeters can be furnished with special posts and links at an additional charge of 20% to the list price of the lower capacity instrument. For example: a Catalog No. 1800 GSA single phase wattmeter, capacities 1 ampere and 100-150 volts, scale 0-125 watts, can be furnished with special posts and links to increase the current capacity to 2 amperes at \$92.50 list plus 20% or \$111.00 list. The wattmeter is a single current capacity instrument when the current coils are connected in series and the current capacity is doubled by connecting the current coils in parallel.

IN ORDERING, specify quantity, catalog number, special features, if any, operating voltage and transformer ratios where instruments are used with external transformers.

Alternating Current Portable Instruments

TYPE GSA

*Frequency Meters and Power Factor Meters



FREQUENCY METERS

Cat. No.	†Cycles	Volts	List Price	Cat. No.	†Cycles	Volts	List Price
1850	15-35	100-150	\$140.00	1856	105-155	100-150	\$140.00
1851	15-35	200-300	155.00	1857	105-155	200-300	155.00
1852	15-35	400-600	170.00	1858	105-155	400-600	170.00
1818	20-65	100-150	155.00	1859	400-600	100-150	160.00
1819	20-65	200-300	170.00	1860	400-600	200-300	175.00
1820	20-65	400-600	185.00	1861	400-600	400-600	190.00
1862	30-60	100-150	140.00		{ 15-35 }		
1863	30-60	200-300	155.00	1641	{ 45-75 }	100-150	210.00
1864	30-60	400-600	170.00		{ 15-35 }		
1853	45-75	100-150	140.00	1642	{ 45-75 }	200-300	232.50
1854	45-75	200-300	155.00		{ 15-35 }		
1855	45-75	400-600	170.00	1643	{ 45-75 }	400-600	255.00

†POWER FACTOR METERS

Cat. No.	Amps.	Volts	Phases	Wires	List Price	Cat. No.	Amps.	Volts	Phases	Wires	List Price
1875	5	100-150	3	3	\$110.00	1881	5	100-150	2	4	\$130.00
1876	5	200-300	3	3	120.00	1882	5	200-300	2	4	140.00
1877	5	400-600	3	3	135.00	1883	5	400-600	2	4	155.00
1878	5	100-150	2	3	125.00						
1879	5	200-300	2	3	135.00						
1880	5	400-600	2	3	150.00						

We are prepared to supply and on request will quote on Reactive Factor meters and Reactive Kilovolt Ampere meters.

† indicates stock item.

Scales are readable throughout their entire length.

For power factor meters with ampere capacities higher than 5 amperes use external current transformers with the 5 ampere instruments.

For power factor meters for voltages higher than those listed use external voltage transformers and external current transformers.

For frequency meters for voltage higher than those listed use external voltage transformers.

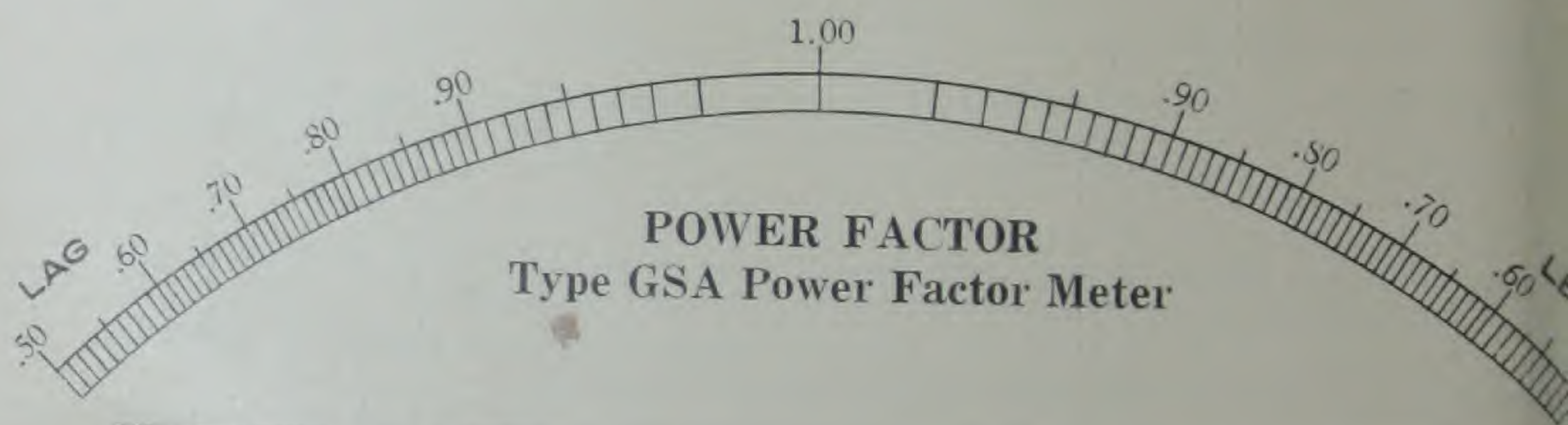
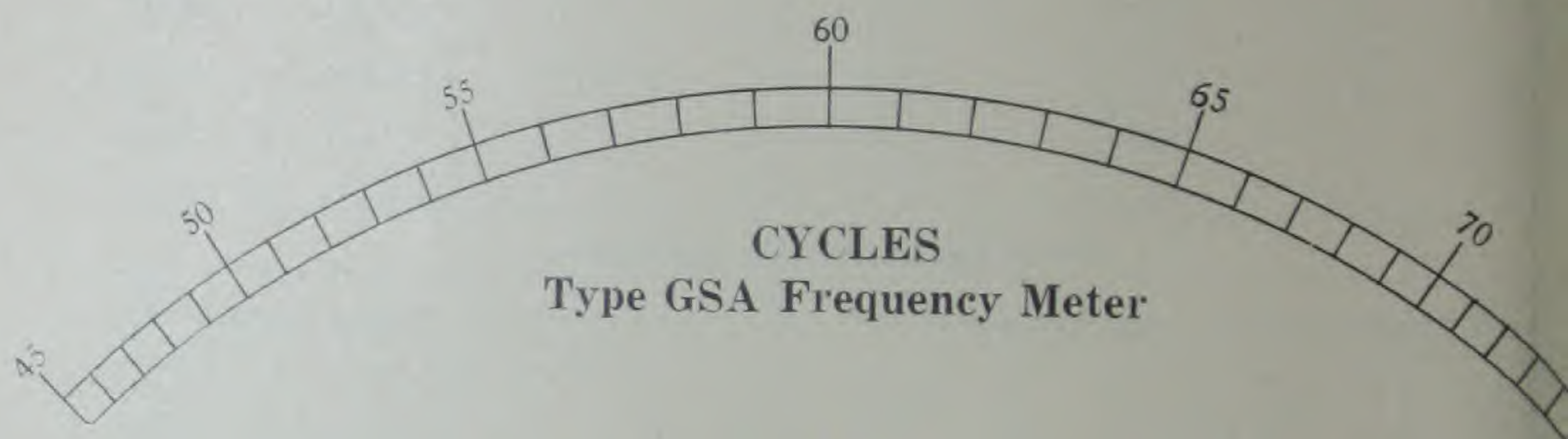
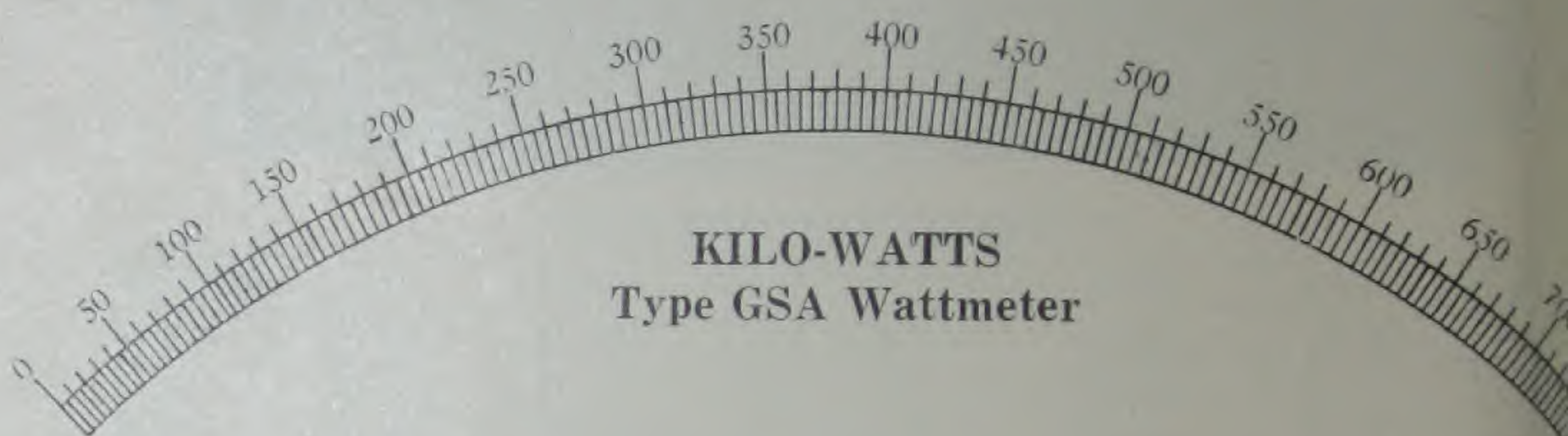
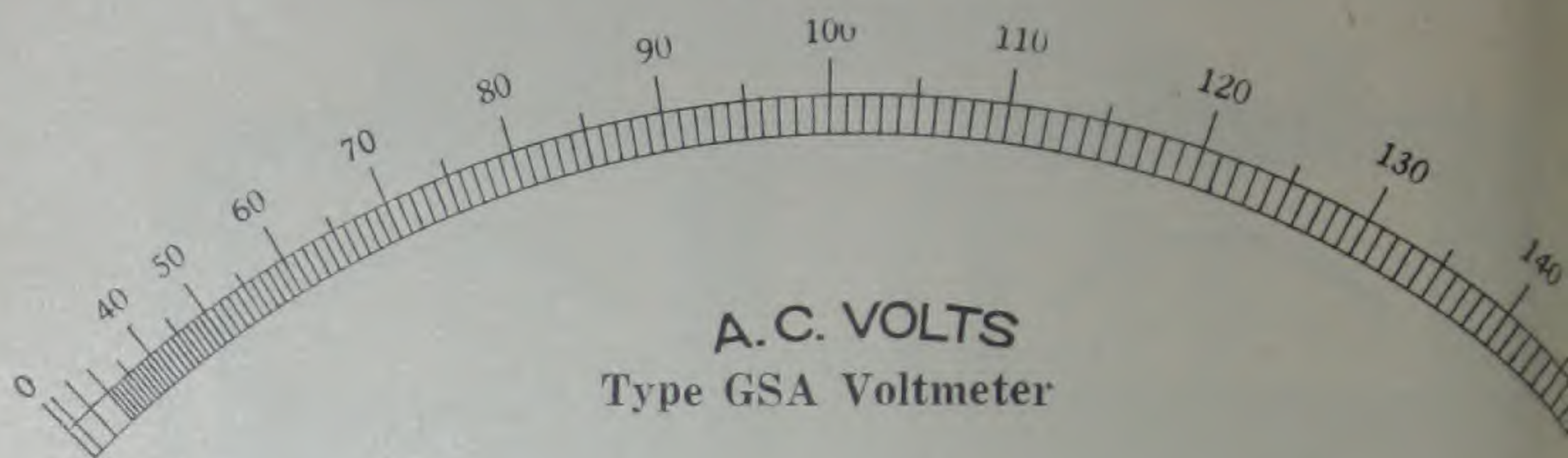
For frequency meters and power factor meters with two or three voltage capacities add \$15.00 to list price of highest voltage capacity involved for each additional capacity.

All power factor meter scales read .5-1.0-.5.

See page 14 for listing of transformers.

IN ORDERING, specify quantity, catalog number, special features, if any, operating voltage and frequency, and, in those cases where instruments are to be used with external current or voltage transformers, the ratios of such transformers.

Alternating Current Portable Instruments FAC-SIMILE SCALES (Full Size)

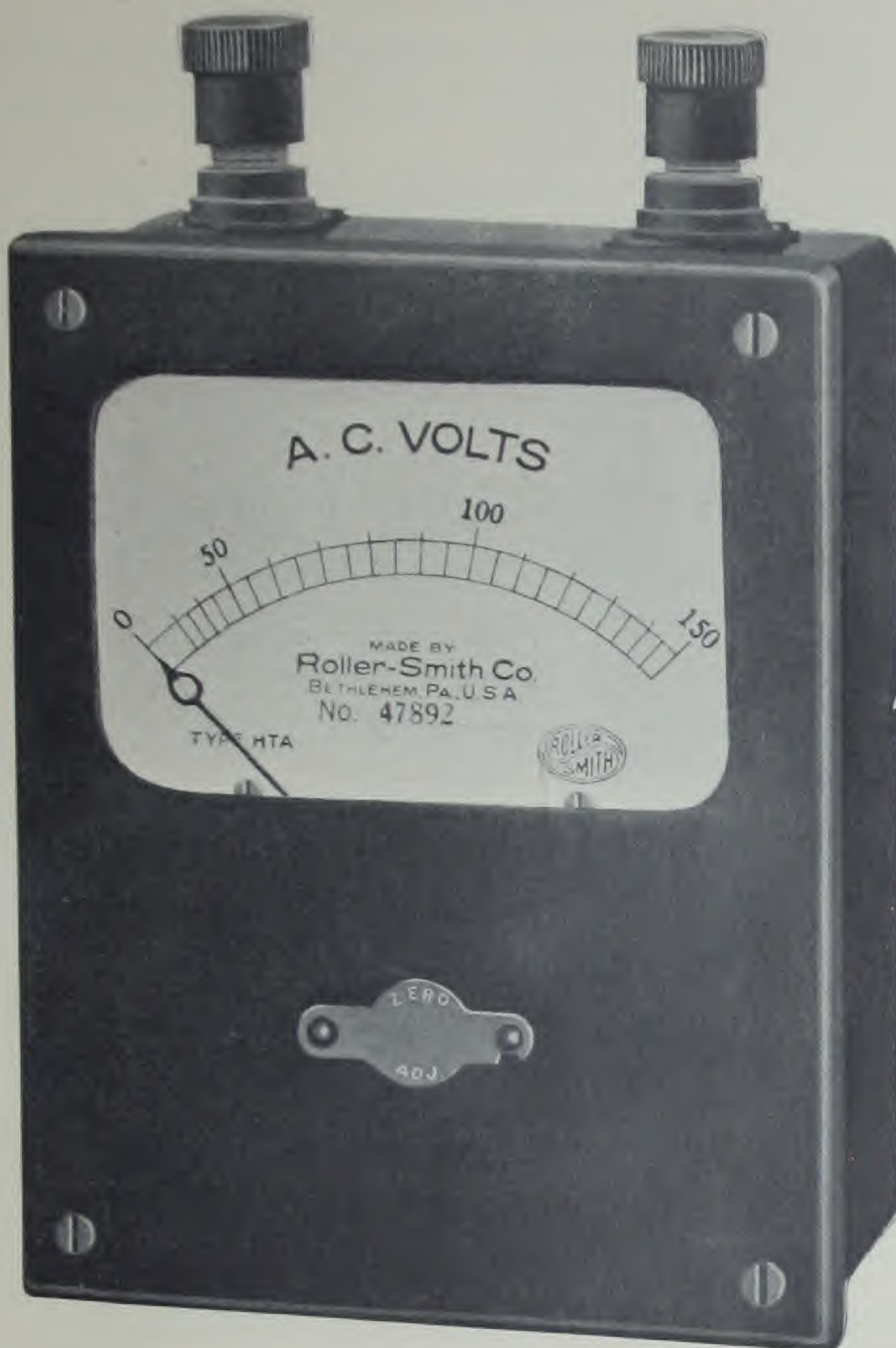


DIRECT CURRENT PORTABLE INSTRUMENTS

Roller-Smith Bulletin No. 210 covers a complete line of direct current ammeters, voltmeters and volt-ammeters, and in addition, portable direct current galvanometers. The first three mentioned, known as the Type GSD, are similar, as far as case styles and sizes are concerned, to the Type GSA line, listed in this Bulletin. A copy of Bulletin No. 210 will gladly be sent to anyone on request.

Type HTA

Small Portable Alternating Current
Ammeters, Milli-Ammeters, Voltmeters



(Full Size)

DIRECT CURRENT PORTABLE INSTRUMENTS

Roller-Smith Bulletin No. 110 covers a complete line of direct current ammeters, voltmeters and volt-ammeters. This line of instruments, known as the Type HTD, is similar, as far as case styles and sizes are concerned, to the Type HTA line listed in this Section. A copy of Bulletin No. 110 covering the HTD line will gladly be sent to anyone on request.

Type HTA

Small Portable, Alternating Current Ammeters, Milli-Ammeters, Voltmeters

GENERAL

With the rapidly increasing use of alternating current for all kinds of applications there is an ever-increasing demand for smaller and less expensive alternating current measuring instruments than the regular run of portable devices that have heretofore been available.

Several years ago the ROLLER-SMITH COMPANY put on the market its well-known Type HA instruments, large numbers of which have been sold and are giving 100% satisfaction. However, there has since come up a demand for a still smaller instrument, one which is truly of "pocket size."

To meet this demand the ROLLER-SMITH COMPANY has developed and offers the type HTA alternating current portables shown in this Bulletin, the HTA superseding the HA. The HTA is a real pocket portable (see cut on preceding page) and the prices are extremely low for such high quality instruments.

These instruments are suitable for general testing of A. C. motor and generator circuits, light and power circuits, household appliances, etc. They are useful to electrical contractors, plant electricians, "trouble shooters," students and to schools and colleges.

The ROLLER-SMITH line of Type HTA portable instruments comprises ammeters up to and including 50 amperes and voltmeters as high as 300 volts. The ammeters can of course, be used for higher currents by means of 5 ampere capacity instruments with external current transformers having suitable ratios of transformation.

In order to combine in one instrument the ranges of several individual ones we supply voltmeters with double and triple ranges. Where multi-range ammeters are needed, we recommend 5 ampere capacity ammeters with suitable external current transformers.

Practically all these instruments are so designed so that they may be used on direct current also with good accuracy, this being particularly true of the ammeters and of the voltmeters of 150 volts and over.

DESCRIPTION

Mechanisms are of the electro-magnet type and are so mounted that the parts cannot get out of alignment.

Pivots are hardened steel, accurately ground and polished.

All instruments are individually calibrated.

Cases are light but rigid metal with black rubberoid finish. The cases are so constructed as to be practically dust proof and moisture proof and, if we are advised that the instruments are to be used in tropical countries or under humid conditions, additional precautions will be taken to exclude moisture and protect the dial.

Connections are in the form of binding posts with non-removable tops so arranged that the binding posts cannot turn.

Dials are pure white bristol board of the highest grade and the scales are drawn in by hand in accordance with the characteristics of each instrument. Non-fading black India ink, which retains its legibility indefinitely, is used in all types.

Pointers are light but rigid aluminum.

Glasses are free from flaws and are firmly fastened in place.

All instruments are provided with a convenient and efficient zero adjuster.

Springs are of phosphor-bronze, well aged to minimize zero shifting.

All the instruments are accurate to within $1\frac{1}{2}\%$ of full scale value.

Dimensions of the instruments are $3\frac{1}{2}$ " wide $4\frac{1}{2}$ " high and $1\frac{1}{2}$ " deep. Average net weight is 1 pound, 4 ounces and shipping weight 2 pounds, 4 ounces.

All scales are 2.1" long.

†MILLI-AMMETERS

CAT. NO.	RANGE IN MILLI-AMPERES	VALUE PER SCALE DIVISION	LIST PRICE
1562	0- 50 M.A.	2.0 M.A.	\$18.75
1500	0-100	2.5	18.75
1568	0-150	5.0	18.75
1570	0-200	5.0	18.75
1572	0-300	10.0	18.75
1574	0-400	10.0	18.75
1504	0-500	20.0	18.75
1505	0-800	20.0	18.75

†AMMETERS

1506	0-1 Amp.	.025 Amp.	18.75
1507	0-1.5 Amps.	.05	18.75
1508	0-3	.1	18.75
1510s	0-5	.2	18.75
1512s	0-10	.25	18.75
1514s	0-15	.5	18.75
1516s	0-30	1.0	18.75
1518s	0-50	2.0 Amps.	18.75

†VOLTMETERS

CAT NO.	RANGE IN VOLTS	VALUE PER SCALE DIVISION	LIST PRICE
1511	0- 10 Volts	.25 Volt	\$18.75
1513	0- 15	.5	18.75
1578	0- 20	.5	18.75
1520	0- 30	1.0	18.75
1522	0- 50	2.0 Volts	18.75
1524	0- 80	2.0	18.75
1526	0-100	2.5	18.75
1528s	0-150	5.0	18.75
*1532s	0-300	10.0	22.50
1531	0- 15 0- 30	.5 Volt 1.0	22.50
1532	0- 50 0-100	1.0 2.0 Volts	22.50
1533	0- 75 0-150	2.5 5.0	22.50
*1534s	0-150 0-300	5.0 10.0	26.25
*1535s	0- 75 0-150 0-300	2.5 5.0 10.0	30.00

*Has external resistor for the 300 volt range.

"s" indicates stock item.

†Readable portion of scale of ammeters and voltmeters is from 20% of scale to full scale.

The double and triple range voltmeters listed above are the only combinations of voltage ranges that can be supplied in the Type HTA. Other combinations can be supplied in the Type GSA as listed on page 6 of this Bulletin.

Cat. No. 12206, leather carrying case for use with any self-contained Type HTA ammeter or voltmeter..... \$3.25 List.

Prices on leather carrying cases for voltmeters having external resistors will be quoted on application.

DIRECTIONS FOR ORDERING: Specify quantity and catalog number.

Portable Type Instrument Transformers & Multipliers

CURRENT TRANSFORMERS

These are designed for use with five ampere capacity instruments and can be used on circuits up to 2500 volts, 25 to 133 cycles. The secondary winding is connected to the instrument by flexible leads. The secondary circuit should never be opened under any circumstances while current is flowing through primary.

Special Semi-Portable Type ROWD Current Transformers

This type combines a 25 ampere wound primary and an open type primary with a standard 5 ampere secondary winding connected to a pair of 6-foot flexible leads. Primary opening is one by two inches. Can be used with either ammeter or wattmeter or both together. The following ratios can be obtained:

OPEN PRIMARY	RATIO
Conductor once through opening.....	500-5 Amperes.
Conductor twice through opening.....	250-5 Amperes.
Conductor four times through opening.....	125-5 Amperes.
Conductor five times through opening.....	100-5 Amperes.

WOUND PRIMARY

Conductor connected to binding posts.....	25-5 Amperes.
Net weight, 4 lbs.	Size, 4¼"x4"x2½."

Cat. No. 1580s, Type ROWD current transformer.....\$40.00 list

"s" indicates stock item.

VOLTAGE TRANSFORMERS

These are furnished only in the switchboard type and are listed for various voltage ratios and watt capacities in Bulletin No. 450, furnished on application.

DISCOUNTS ON TRANSFORMERS ARE THE SAME AS ON THE INSTRUMENTS IN THE BULLETIN.

TYPE GS MULTIPLIERS

These are used to increase the voltage capacities of voltmeters and indicating wattmeters, both A. C. and D. C. and consist of non-inductively wound resistances of appropriate values with suitable containing cases. A multiplier is used by connecting it in series with the voltage winding of the instrument and enables the instrument to be used on a higher voltage.

Each multiplier must be adjusted for use with its own particular instrument and hence multipliers are not interchangeable.

They are supplied in cylindrically-shaped cases with black composition base and top and with suitable binding posts.

When ordered for use with a multiple range or capacity instrument, the multiplier is always arranged for use with the highest range or capacity of the instrument.

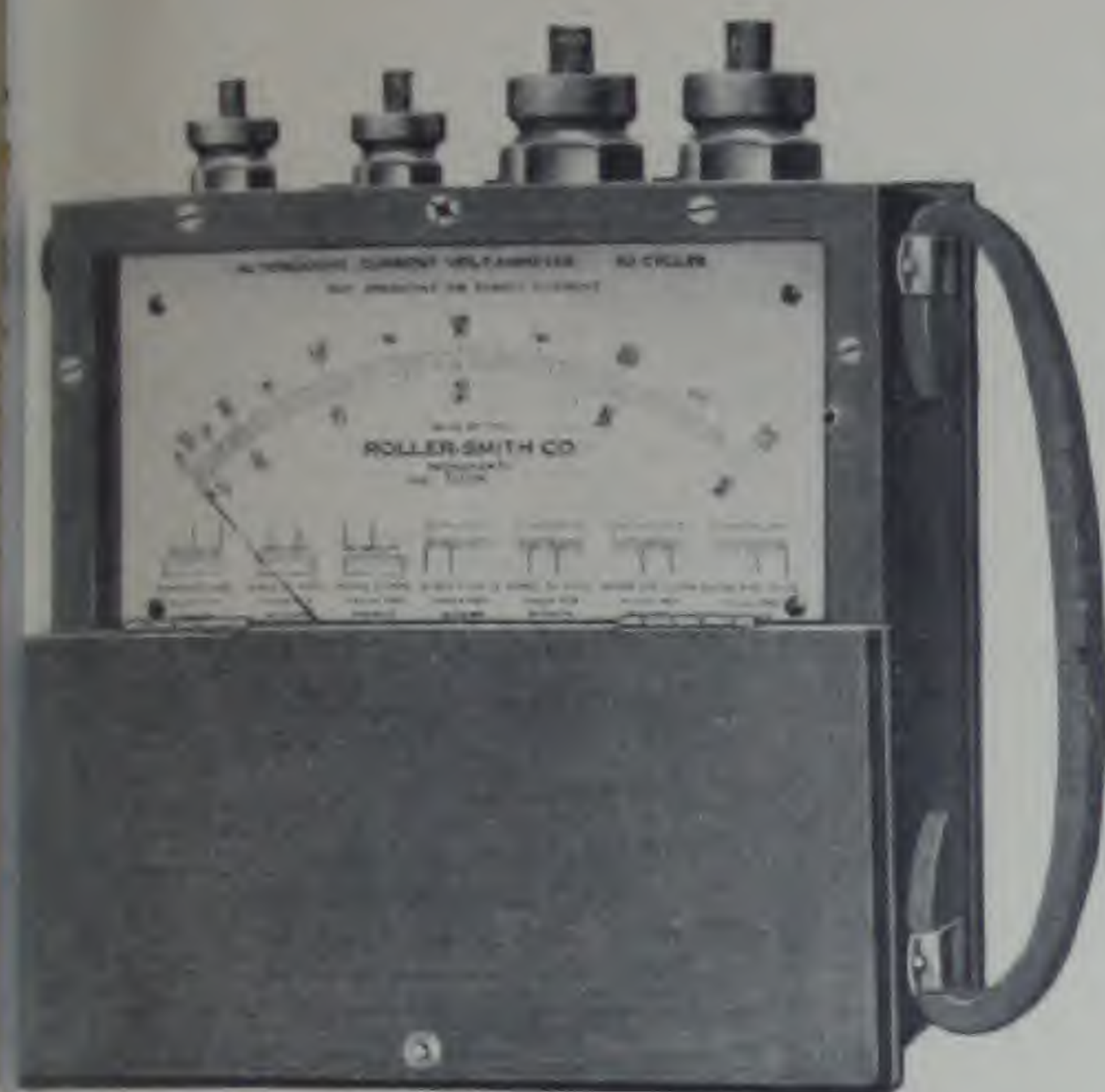
Cat. No.	Voltage Range of Instrument		Ratio	List Price
	Without Multiplier	With Multiplier		
*2380	3 Volts	150 Volts	50 to 1	\$25.00
*2381	3 "	300 "	100 " 1	27.50
*2382	3 "	600 "	200 " 1	32.50
*2383	3 "	750 "	250 " 1	35.00
*2384	15 "	150 "	10 " 1	25.00
*2385	15 "	300 "	20 " 1	27.50
*2386	15 "	600 "	40 " 1	32.50
*2387	15 "	750 "	50 " 1	35.00
2388	50 "	100 "	2 " 1	25.00
2389	50 "	750 "	15 " 1	35.00
2390	150 "	300 "	2 " 1	25.00
2391	150 "	600 "	4 " 1	30.00
2392	150 "	750 "	5 " 1	32.50
2393	300 "	600 "	2 " 1	27.50
2394	750 "	1500 "	2 " 1	45.00
2395	750 "	3000 "	4 " 1	60.00

*For voltmeters only.

These multipliers can be supplied with taps for intermediate voltages at an extra cost of \$5.00 list per tap. For example, assume a 15 volt voltmeter and a multiplier with three taps is wanted to increase the range respectively to 150, 300 and 600 volts, i.e., with three ratios, namely, 10 to 1, 20 to 1, and 40 to 1. Such a multiplier lists at \$32.50 for the 15 to 600 volt (40 to 1) multiplier, plus \$5.00 for the 300 volt tap and plus \$5.00 for the 150 volt tap or a total of \$42.50.

IN ORDERING specify catalog number of multiplier and serial number of instrument for which multiplier is to be adjusted.

Alternating Current Type ISA Volt-Ammeters



Cat. No. 1005

Dimensions 7x6 $\frac{7}{8}$ x4 $\frac{1}{4}$ inches; weight 7 lbs.

The rapid advances made in electric signaling and train control show an increasing tendency toward the use of alternating current, and, as in the case of the direct current apparatus, suitable instruments are requisite. The problem of their design was, however, of much greater magnitude, and was solved only after long and expensive design and experimental work. The uses for the Type ISA volt-ammeter are not confined to signal system and automatic train control testing. It fills the requirements for all general alternating current testing within its ranges. This alternating current volt-ammeter finds favor with those who heretofore have been forced to carry around a varied assortment of ammeters and voltmeters ranging in number from two to seven or more.

The case is of black walnut and handsome in appearance. It is provided with substantial leather handle, hinged cover and snap catch. **Binding posts** are heavy and have non-removable tops. Each binding post is legibly marked with a numeral corresponding to the scale value which is obtained when said binding post is employed. A **zero adjuster** convenient for manipulation is incorporated. Particular attention is called to the method of indicating by diagrams on the dial the proper connections for the seven different ranges, and data covering the values per scale division. These instruments operate only on alternat-

ing current and are calibrated for the frequency on which they are to be used. Scales are 5.15" long. Dials are not affected by moisture or by changes in temperature. Accuracy is within 1% of full scale value at any point on the scale provided the frequency is within 3% of that for which the instrument is calibrated.

We invite correspondence regarding special combinations not listed.

PRICE LIST

Cat. No.	**RANGES	Value per Scale Division	List Price
*1005s	0- 6 Volts	.05 Volt	\$160.00
	0- 30 "	.25 "	
	0-120 "	1 "	
	0-240 "	2 Volts	
	0- 3 Amps.	.025 Amp.	
	0- 12 "	1 "	
	0- 60 "	5 "	
†1028s	0- 6 Volts	.04 Volt	170.00
	0- 15 "	.1 "	
	0-150 "	1 "	
	0-300 "	2 Volts	
	0- 3 Amps.	.02 Amp.	
	0- 15 "	1 "	
	0- 30 "	2 "	

*The Cat. No. 1005 instrument can be supplied with an additional range of 0-600 volts at a total list price of \$170.00. The 600 volt range requires an external resistor which resistor increases the 240 volt range to 600.

†The Cat. No. 1028 instrument can be supplied with an additional range of 0-600 volts at a total list price of \$180.00. The 600 volt range requires an external resistor which resistor increases the 300 volt range to 600 volts.

"s" indicates stock item.

*Readable portion of scale is from about 20% of full scale to full scale.

The 0-600 volt scale is not shown on the dial, it being possible to use the proper multiplying constant in connection with one of the standard ranges.

In both cases the external multiplier is about 6" long by 1 $\frac{1}{8}$ " in diameter, one terminal being of the spade type for attachment to the proper binding post on the instrument and the other terminal being of the binding post type to which one of the wires of the circuit to be tested is attached.

Directions for Ordering: Specify quantity, catalog number and operating frequency.

ROLLER-SMITH Products comprise complete lines of Electrical Instruments, indicating and graphic, Relays and air and oil Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees **all** its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Representatives

Sales Offices

ATLANTA	101 Marietta Street	NEW YORK	233 Broadway
BOSTON	88 Broad Street	NEW ORLEANS	Masonic Temple
BUFFALO	Ellicott Square Building	OMAHA	W. O. W. Building
CHICAGO	53 W. Jackson Blvd.	PHILADELPHIA	Otis Building
CLEVELAND	1988 E. 66th Street	PITTSBURGH	First Nat. Bank Bldg.
DENVER	Kittridge Building	ST. LOUIS	Natl. Bk. of Com. Bldg.
DETROIT	Fisher Building	ST. PAUL	Pioneer Building
HOUSTON	1006 Washington Avenue	SAN FRANCISCO	163-2nd Street
LOS ANGELES	912 E. Third Street	SEATTLE	Alaska Building
MONTREAL	Tramway Building	TORONTO	183 George Street

ABROAD

THRELL ELECTRIC COMPANY	Box 2049, Havana, Cuba
DUVAL TRADING CO.	Kembla Bldgs., Sydney, Australia
ASHIDA ENGINEERING CO.	Daini, Osaka, Japan
MANILA MACHINERY & SUPPLY CO., INC.,	Box 607, Manila, Philippine Islands



BULLETIN No. 200
AUGUST, 1927
(Superseding issue dated December, 1925)



Portable, Direct Reading RAIL BOND TESTERS

Type SBT (Standard Sensibility)

Type BBT (High Sensibility)



Type SBT Bond Tester in use

ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



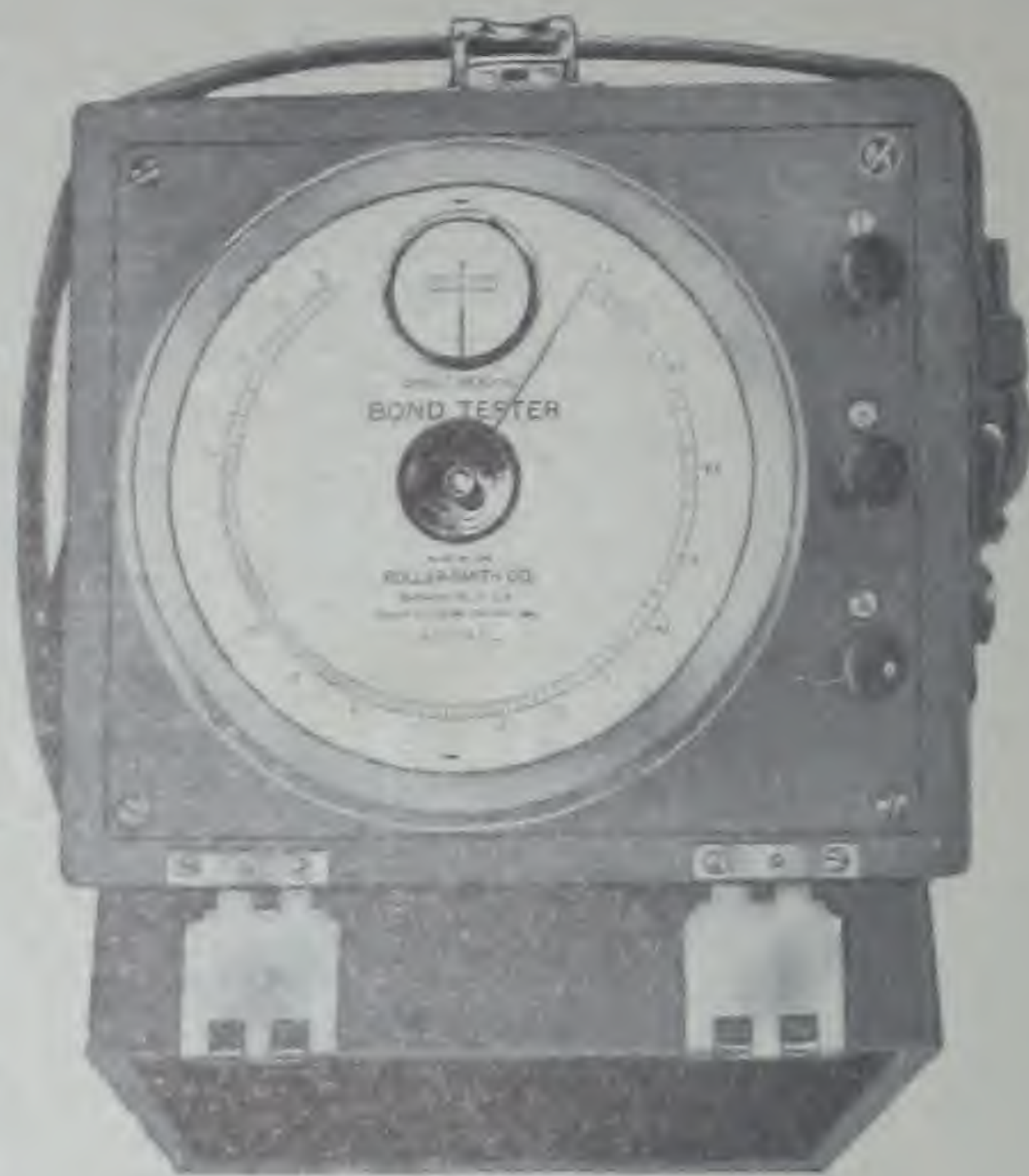
WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada,

*Representatives in
Australia, Cuba and Japan*

ROLLER-SMITH

Portable, Direct Reading RAIL BOND TESTERS



Front View (Both Types)
Size $8\frac{1}{4} \times 7\frac{1}{4} \times 6$ inches

Application

ON all electric railway systems employing the rail as the return circuit the rail ends are electrically connected by means of bonds of various forms. It is essential that these bonds be maintained in perfect condition and that contact with the rail be unimpaired, otherwise resistance is introduced with consequent useless waste of energy. The sum total of the waste resulting from imperfect bonding is astonishing.

The purpose of this Bulletin is to describe the ROLLER-SMITH Direct Reading Bond Tester, which was designed many years ago for this particular application. There are more ROLLER-SMITH Bond Testers in use in this country than all other makes combined. In foreign countries also this instrument is widely and favorably known.

ROLLER-SMITH Bond Testers are used also very extensively in coal and other mines where the trolley type of electric locomotive is employed. For this application bond testers are very useful in checking up bonds and thus keeping voltage drop down to a minimum.

Description

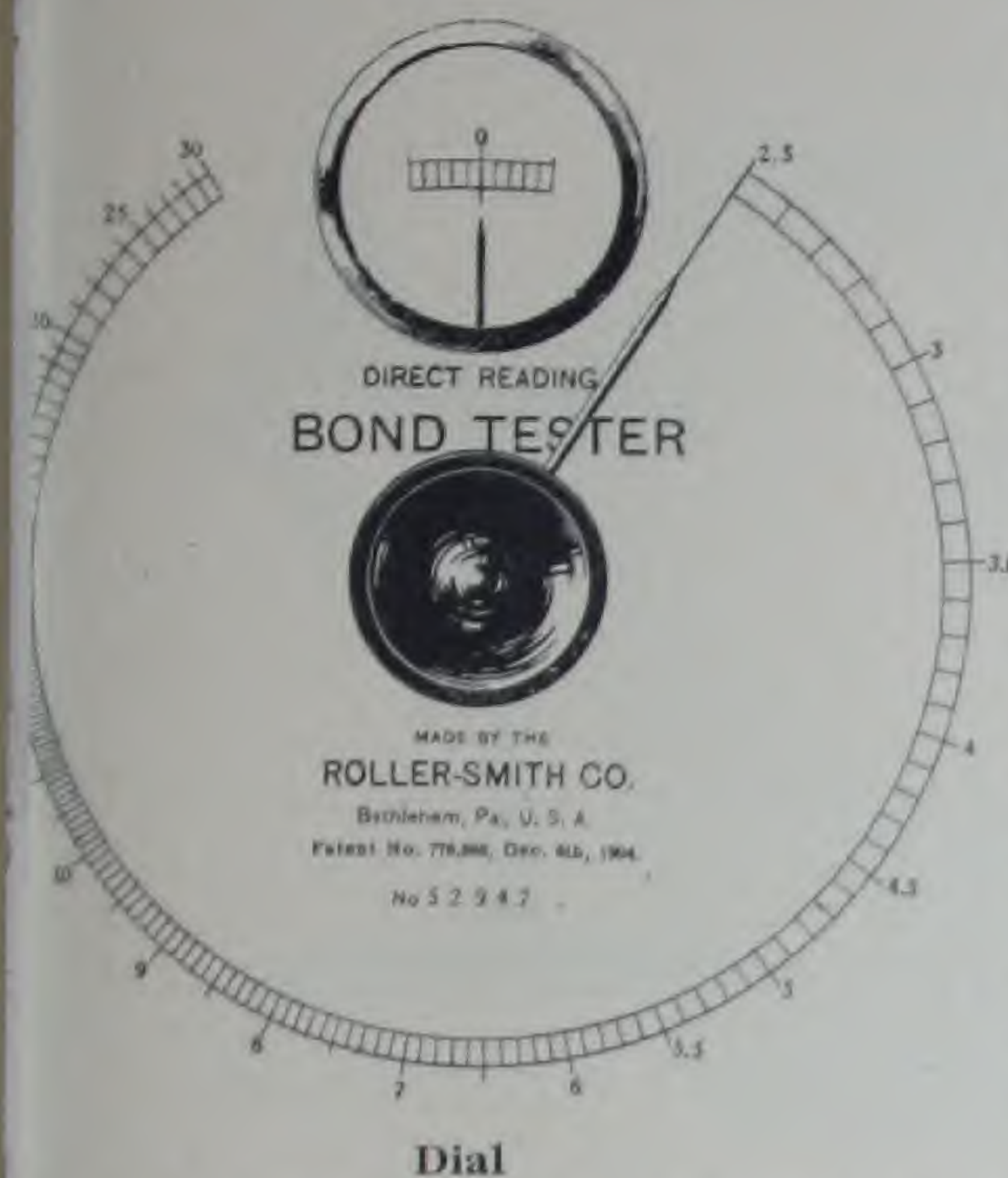
Type SBT (Standard Sensibility)

The ideal bond tester should be light and compact so that it may be carried about for long periods without fatigue; it should show the resistance of the bond under test direct on the scale without involving any computation; it should be operative on the current normally flowing in the rail without requiring the presence of some special source; a single observer should be capable of taking rapid, accurate readings and it should, of course, be substantially built and moderate in cost. If, in addition, it should be capable of showing instantaneously whether the bond resistance is above or below any predetermined value, so much the better.

The comparison of milli-volts drop across the bond with milli-volts drop along a standard rail length is unsatisfactory because of the fluctuating value of current through the rail, a fundamental objection which can be met only by the employment of some zero method. The most satisfactory zero method obviously involves the use of a bridge net-work. By fashioning such a net-work in which the ratio arms are contained within

ROLLER-SMITH

Portable, Direct Reading RAIL BOND TESTERS



Dial
Dial length $10\frac{1}{2}$ inches. Range $2\frac{1}{2}$ to 30 feet.

In the instrument, the standard arm is a section of unbroken rail and the "X" arm the bond, balance attainable either by varying unbroken rail length or by varying arm ratios, maintaining a constant section of unbroken rail as the standard. While the former expedient is sometimes employed it is clumsy for it necessitates a progressive shifting of one rail contact relative to two stationary ones, a procedure which is slow and requires the services of an added attendant. In the ROLLER-SMITH Bond Tester we have eliminated these drawbacks by adopting variable ratio arms self-contained within the device itself and hence manipulable by the observer without disturbing rail contacts in any way.

Aside from the ratio arms just referred to, the instrument contains a suitable galvanometer, highly sensitive so as to be responsive to small current flows, and, at the same

time, capable of withstanding extremely heavy overloads. The containing case is arranged with a double hinged cover which opens downward at right angles to the top of the tester, forming thus, in conjunction with the strap which is passed around the neck of the observer, a very satisfactory means of supporting the instrument in a horizontal position at a convenient distance from the observer's eye. A conveniently located push button, the manipulation of which serves to open and close the galvanometer circuit, enables one to obtain a cumulative impulse effect, which is desirable when striving for accurate balance with feeble currents.

In addition to the instrument there is the contact bar to which it is connected by means of an appropriate three conductor cord having numbered terminals matching the instrument and bar terminal numerals.

While it might at first thought seem that the contact bar is a trivial proposition, serving merely as a convenient means of establishing contact with the rail at three selected points, it actually is of cardinal importance. The scale and silicious matter which becomes rolled into a rail head in a very short time is a bad conductor and it is necessary to pierce that skin before satisfactory contact can be established. Extended experience has shown that chisel points are quite unsatisfactory for the purpose, as, no matter how well tempered or carefully sharpened, the blunting is rapid and the subsequent results erratic. In the ROLLER-SMITH contact bar this

CIRCUIT
BREAKERS

RELAYS

ROLLER-SMITH

Portable, Direct Reading

RAIL BOND TESTERS

difficulty is remedied by employing at each contact point a pair of hack saw blade pieces arranged in the form of an **inverted "V"** so as to rest on the rounded corners of the rail head. Reference to the accompanying illustration giving the end view of the contact in place on rail will show that, if the bar handle is rocked at right angles to the rail length, the blades will literally saw into the rail head, accomplishing thus in ideal fashion the desired end. The blades are removable by loosening a couple of set screws and may be renewed with bits broken from any ordinary hack saw blade.



Inverted "V" Contacts

On special order and without extra charge we can furnish contacts of the **upstanding "V"** type, as illustrated, for rails of the girder type. These are interchangeable with the **inverted "V"** contacts on the same bar, so that rails of both types can be taken care of.



Upstanding "V" Contacts

The operation of the Bond Tester is independent of the amount of current flowing in the rail, this influencing sensibility only. To obtain good results the current in the rail, assuming a rail weight of 100 pounds to the yard, should be not less than 50 amperes.

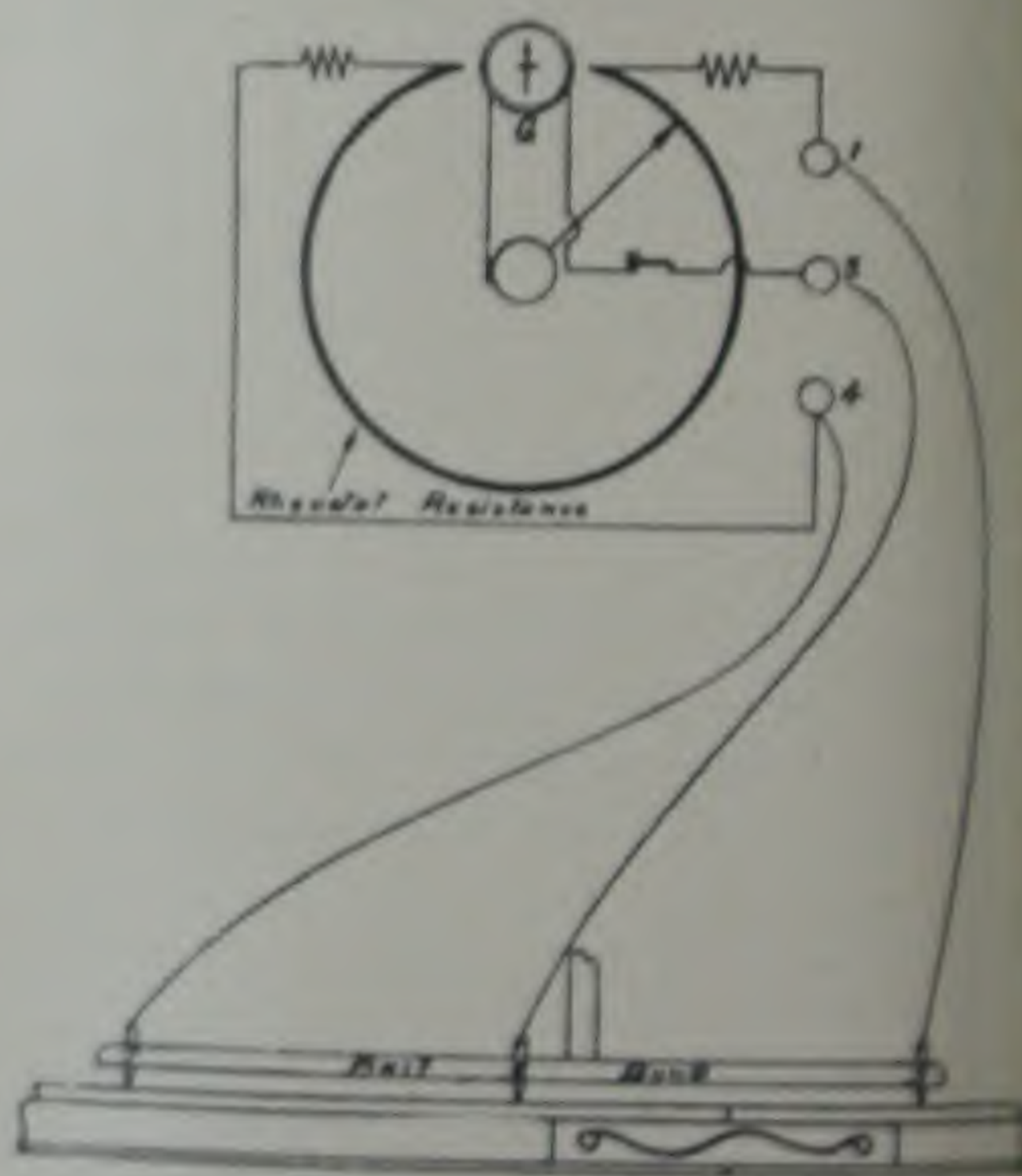
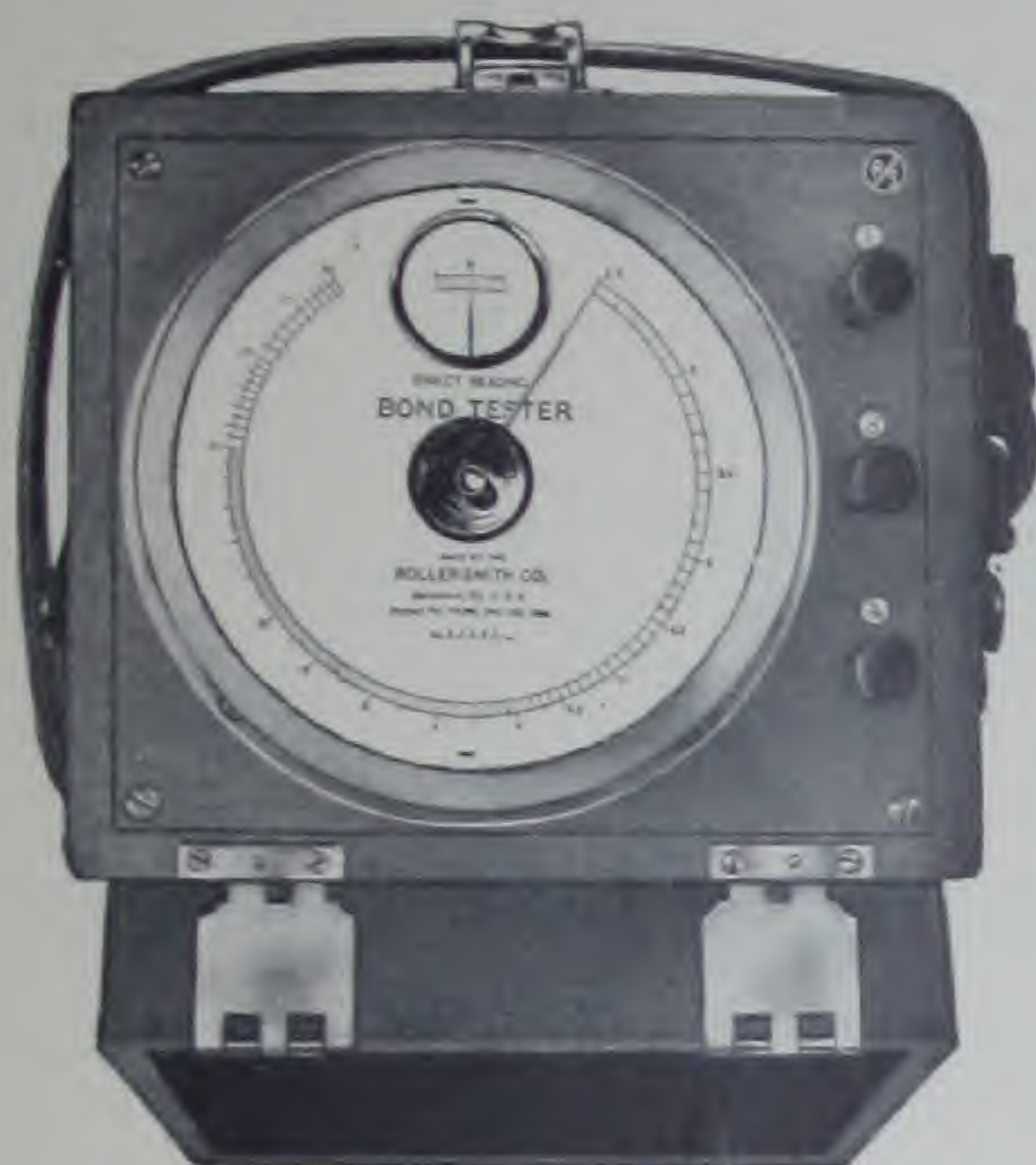


Diagram of Connections

ROLLER-SMITH

Portable, Direct Reading RAIL BOND TESTERS



Front View (Both Types)
Size $8\frac{1}{4} \times 7\frac{1}{4} \times 6$ inches

TYPE SBT (Standard Sensibility)

Cat. No.		List Price
*2000	Type SBT Bond Tester, complete with Type S contact bar and leads.....	\$160.00
2002	Type S contact bar alone, with three inverted "V" contacts.....	18.00
2003	Type S contact bar alone, with three upstanding "V" contacts.....	18.00
2004	Inverted "V" contacts alone (set of three).....	10.00
2005	Upstanding "V" contacts alone (set of three).....	10.00
2006	Leads alone.....	7.00

*Price includes contact bar with **inverted** "V" contacts unless contact bar with upstanding "V" contacts is specifically called for, in which case it will be furnished at the same price.

†The Type S contact bar is illustrated on the front cover page.

Weights are as follows:

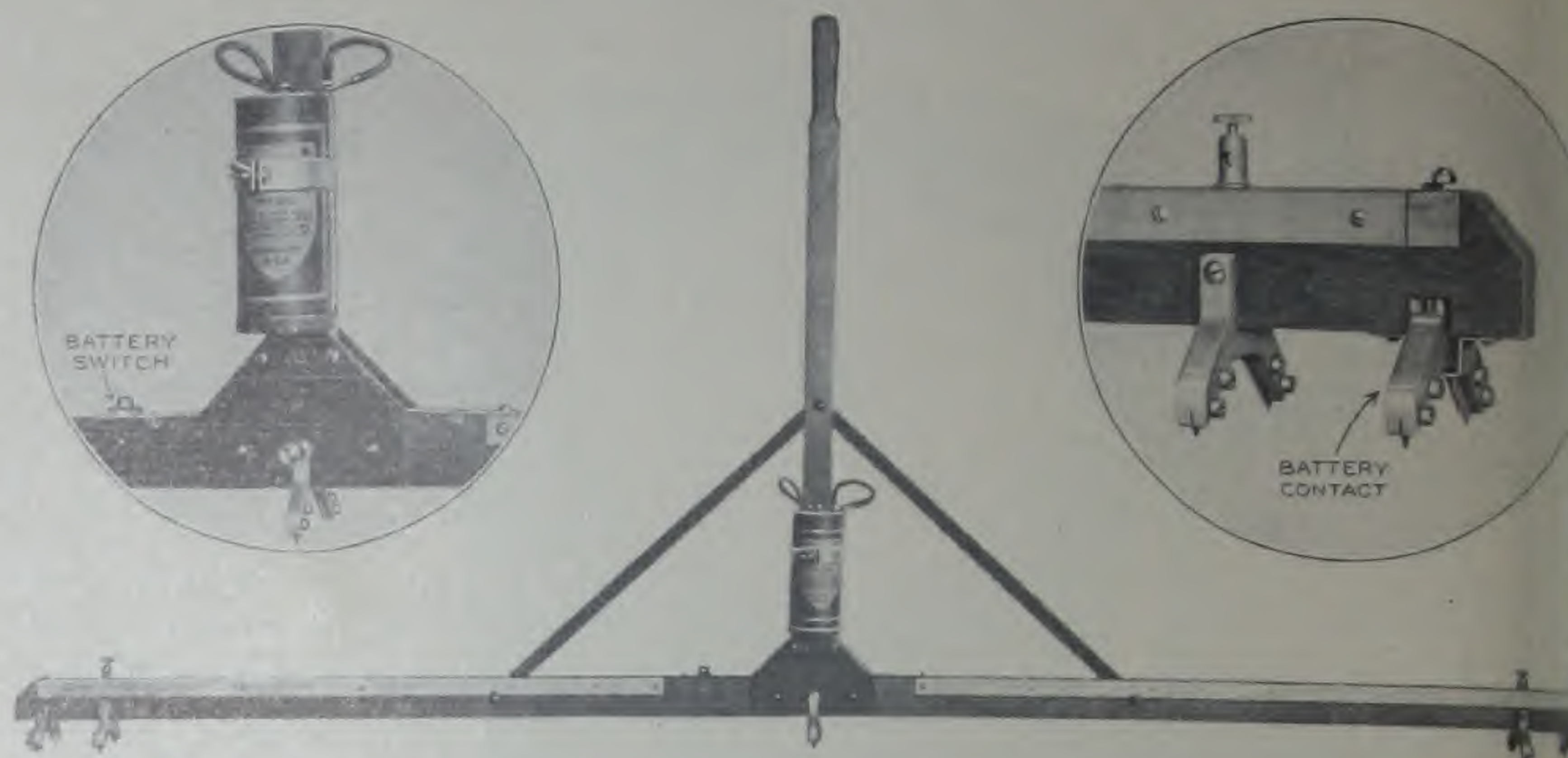
Cat. No. 2000 Type SBT Bond Tester, **without** contact bar, net weight 9 pounds, shipping weight 28 pounds.

Cat. No. 2002 or Cat. No. 2003 Type S Contact Bar, net weight 9 pounds, shipping weight 30 pounds.

ROLLER-SMITH

Portable, Direct Reading

RAIL BOND TESTERS



Type B Contact Bar Used with Type BBT Bond Tester.

DESCRIPTION

Type BBT (High Sensibility)

In addition to the Type SBT Bond Tester described on the preceding pages we offer our Type BBT. Its appearance and operating principle are similar to the SBT but the weight is a few pounds greater and the galvanometer sensibility is **very much** enhanced. The Type BBT is intended for use where the current in the rail is comparatively feeble or where such current is absent, as on new construction or at the ends of trolley lines where no cars are running beyond the point where the tests are being made.

The BBT Type Bond Tester has **much higher** sensitivity than the most sensitive bond tester heretofore made. The significance of that statement lies in the fact that this extremely high sensitivity results in a bond tester that can be **successfully operated with the current from a single dry cell**,

such as that commonly called "No. 6." This achievement makes it possible to dispense with the portable storage batteries, portable resistances and the many and sundry expedients which have heretofore been employed for the purpose of obtaining the current necessary for the operation of bond testers. Dry cells of the kind described are standard the world over and can be obtained without difficulty.

Referring to the illustration above it will be noted that the dry cell is mounted on a bracket which is attached to the upright part of the contact bar. From the dry cell connections run to the spring contacts at the extreme ends of the contact bar. Interposed in the circuit is a small foot-operated push switch mounted in the horizontal part of the contact bar just to the left of the upright member.

ROLLER-SMITH

Portable, Direct Reading

RAIL BOND TESTERS

In operation the contact bar is placed on the rail with the center contact and one of the adjacent contacts spanning the bond and the center contact and the contact on the other side spanning an unbroken length of rail. The contact bar is rocked back and forth a few times so as to make the contacts "bite" into the rail head. If there is sufficient current already in the rail for the operation of the bond tester the dry cell is not used but if the dry cell **is** needed it is necessary merely to depress with the foot the push switch on the horizontal part of the contact bar. When a new dry cell is needed its installation is a matter of but a few moments. The simplicity of the outfit is evident.

As is the case with the Type SBT Bond Tester the contact bar is a **very** important part of the equipment. In the Type BBT the contact bar is of even **greater** importance as there must be perfect rail

contact at **five** different points. The ingenious method of mounting the spring contacts at the two ends of the horizontal bar insures perfect connections for the battery circuit. The entire contact bar is strongly and ruggedly made for the hardest kind of service.

Complete directions for using are contained in a card which is attached to the inside of the lid of the instrument.

The ROLLER-SMITH Bond Tester has been the standard all over the world for many years and this new High Sensibility Type BBT fills the only gap that has theretofore existed—a simple, compact and one-man-operated device for conditions where an external source of current is required.

As is the case with all ROLLER-SMITH apparatus the Type BBT Bond Tester is fully guaranteed—with a guarantee that means something.

Cat. No.		List Price
*2008	Type BBT Bond Tester, complete with Type B contact bar and leads.....	\$250.00
2009	Type B contact bar alone, with five inverted "V" contacts.....	50.00
2010	Type B contact bar alone, with five upstanding "V" contacts.....	50.00
2011	Inverted "V" contacts alone (set of five).....	20.00
2012	Upstanding "V" contacts alone (set of five).....	20.00
2006	Leads alone.....	7.00

*Price includes contact bar with **inverted** "V" contacts unless contact bar with **upstanding** "V" contacts is specifically called for, in which case it will be furnished at the same price.

†The Type BBT Bond Tester can be furnished with leads but **without** contact bar at \$200.00 list. It can be furnished with leads and with Type S contact bar at \$218.00 list.

Weights are as follows:

Cat. No. 2008 Type BBT Bond Tester, **without** contact bar, net weight 9 pounds, shipping weight 28 pounds.

Cat. No. 2009 or Cat. No. 2010 Type B Contact Bar, net weight 14 pounds, shipping weight 35 pounds.

ROLLER-SMITH Products comprise complete lines of electrical measuring and protective apparatus. Bulletins covering the various devices will be sent on request.



WORKS OF
ROLLER-SMITH COMPANY
at
BETHLEHEM, PENNSYLVANIA

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Representatives
in

Atlanta	Detroit	Portland, Ore.
Bethlehem, Pa.	Los Angeles	St. Louis
Birmingham	Montreal	St. Paul
Boston	New Haven	San Francisco
Buffalo	New Orleans	Seattle
Chicago	New York	Toronto
Cleveland	Philadelphia	Tulsa
Dallas	Pittsburgh	Washington, D. C.

Represented abroad by

Duval Trading Co., Kembla Buildings, Sydney, Australia
Thrall Electric Co., Box 2049, Havana, Cuba
Ashida Engineering Co., Ltd., Daini, Osaka, Japan



BULLETIN No. 210
FEBRUARY, 1930
(Superseding issue dated August, 1927
and Bulletin No. 110
dated February, 1928.)



DIRECT CURRENT PORTABLE INSTRUMENTS

Type GSD

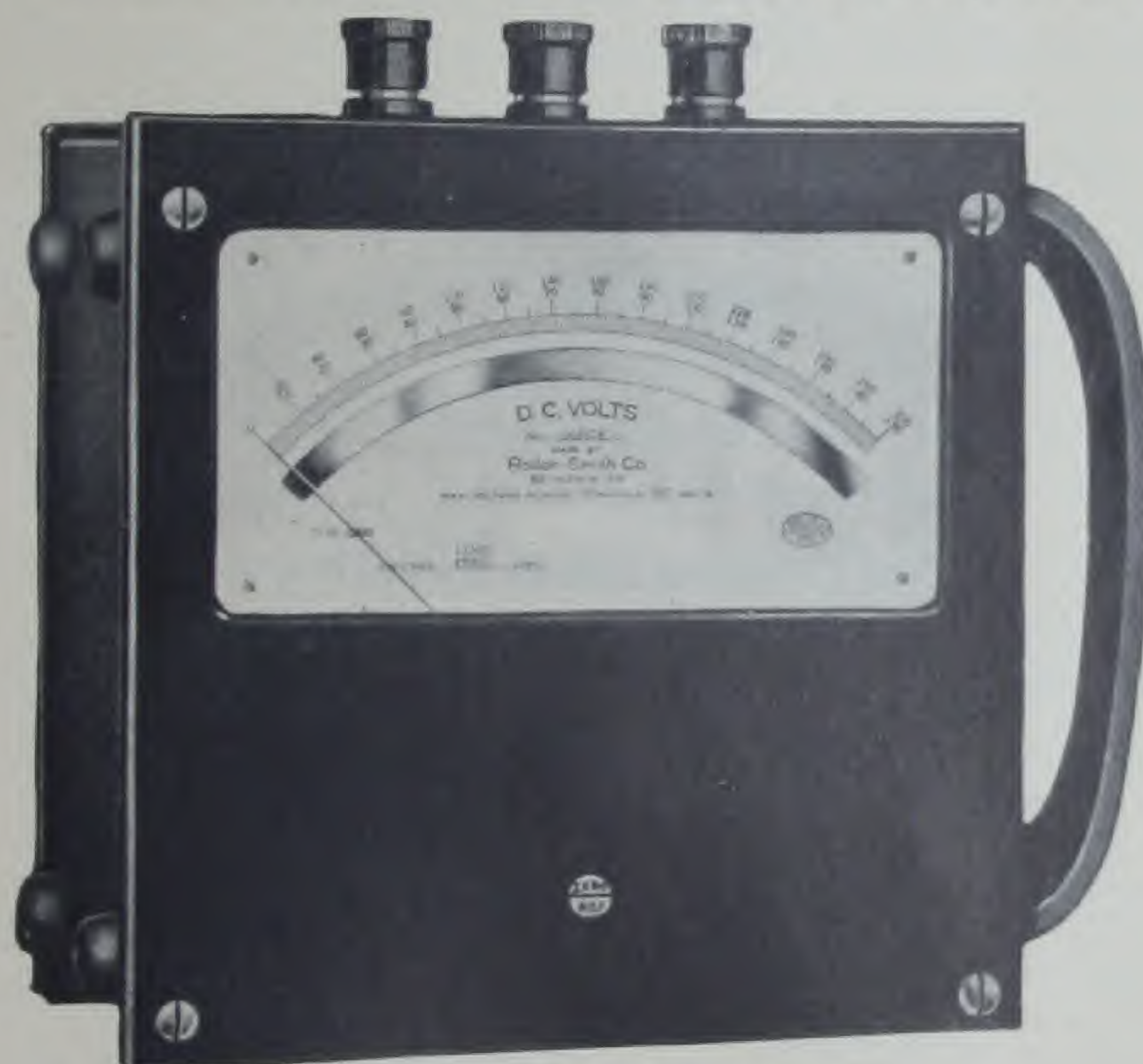
Ammeters, Milli-ammeters, Voltmeters, Milli-voltmeters,
Volt-ammeters, Shunts, Multipliers

Type HTD

Ammeters, Milli-ammeters, Voltmeters, Milli-voltmeters,
Volt-ammeters, Circuit Testers

Types KGD and LGD
Galvanometers

Types ISD and HSD
Volt-ammeters



Type GSD Voltmeter

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

*Representatives in
Australia, Cuba, Japan and Philippine Islands*

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Direct Current Portable Instruments

INTRODUCTORY

This new Bulletin covers all ROLLER-SMITH direct current portable instruments.

GENERAL

We call particular attention to the wide variety of types and ranges listed in this Bulletin—there is truly “an instrument for every need.” Having behind us an experience of over thirty-five years in the manufacture of fine instruments the ROLLER-SMITH COMPANY offers this line with the assurance that every detail of every instrument is in keeping with the exacting standards we have set up as our ideal. ROLLER-SMITH instruments are characterized by:

Efficient designs
The best of materials
Careful assembly
Accurate calibration
Thorough inspection

Added to the above is the inherent quality that is built into every instrument by a factory personnel that takes pride in its product; the fine facilities of a factory that was designed and constructed especially for the manufacture of ROLLER-SMITH apparatus and the honest guarantee that stands back of every ROLLER-SMITH product (see page 20).

SPECIAL INSTRUMENTS

We invite inquiries for special instruments not listed in these pages.

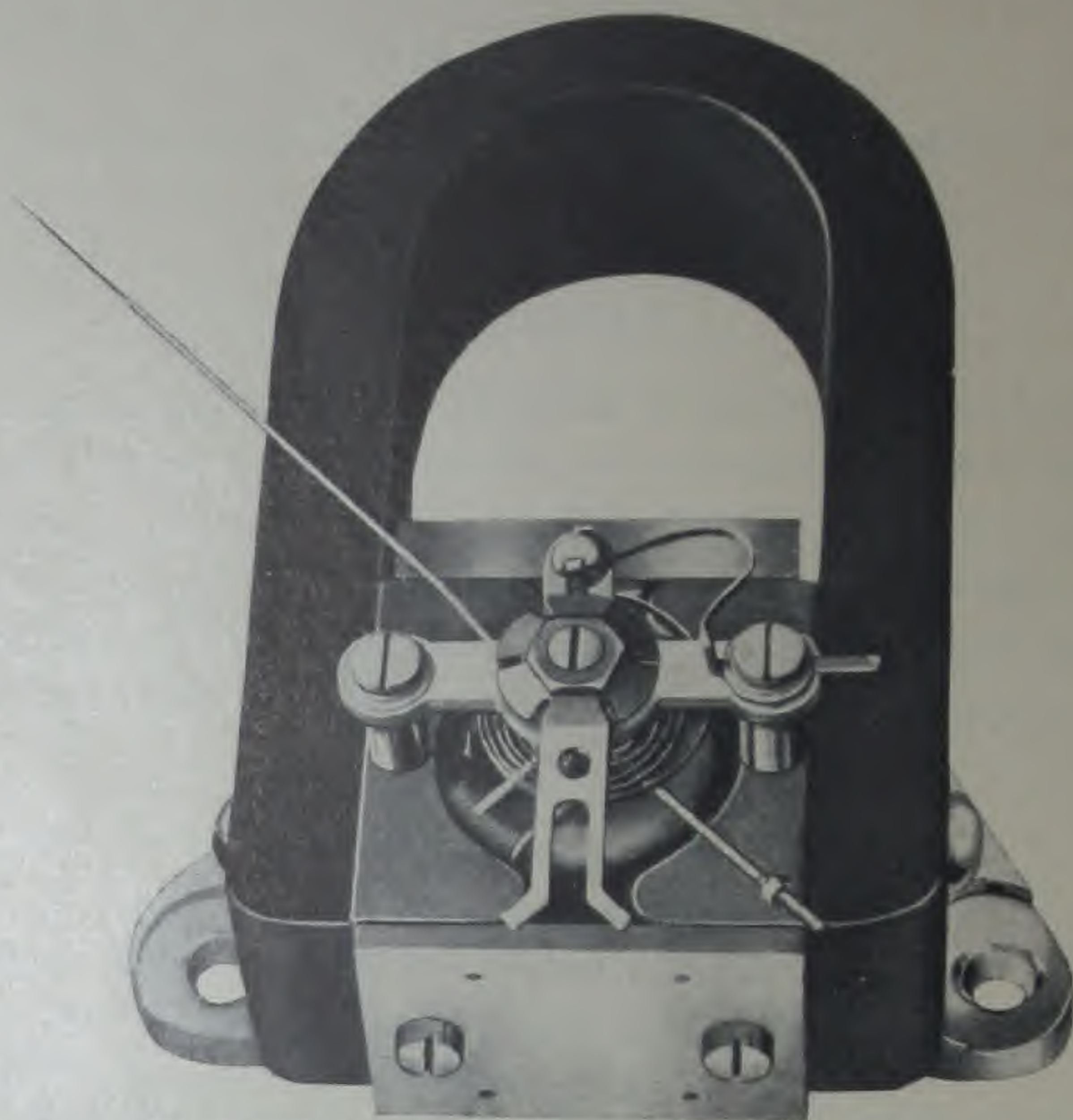
OTHER INSTRUMENTS

In addition to the instruments listed in this Bulletin the ROLLER-SMITH COMPANY makes a wide variety of other instruments. A complete list of all our publications will be sent on request. (*See page 19.*)

CIRCUIT
BREAKERS

RELAYS

Type GSD Direct Current Portable Instruments



Permanent Magnet, Moving Coil Mechanism
used in GSD Instruments

On this page we give the essential details that are common to all the Type GSD instruments listed in this Bulletin.

The pleasing appearance of these instruments and the open, well lighted and easily read scales are outstanding features.

Cases are dust and moisture proof. When we are advised that instruments are to be used under damp or tropical conditions, special precautions are taken to adapt the instruments to those conditions.

Connections are in the form of binding posts with non-removable tops so arranged that the binding posts cannot turn.

A diagram of connections is attached permanently to each instrument.

Magnetic damping insures "dead beat" action of the moving element.

Dials are pure white bristol-board of the highest grade and the scales are drawn in by hand in accordance with the characteristics of each instrument. Non-fading black India ink, which retains its legibility indefinitely, is used in all types.

All scales have uniform divisions.

Pointers are of the knife-edge type.

Glasses are free from flaws and are firmly fastened in place.

All instruments are provided with a convenient and efficient zero adjuster.

Springs are of phosphor-bronze, well aged to minimize zero shifting.

Jewels are best quality Ceylon sapphires.

Mechanisms are so mounted that the parts cannot get out of alignment.

Mechanisms are of the permanent magnet, moving coil type as illustrated on this page.

All instruments are accurate within $\frac{1}{2}$ of 1% of full scale value.

Scales are $5\frac{1}{4}$ " long.

Other details not common to all Type GSD instruments will be found in the section devoted to each particular type.

Type GSD Direct Current

Ammeters, Voltmeters and Volt-Ammeters

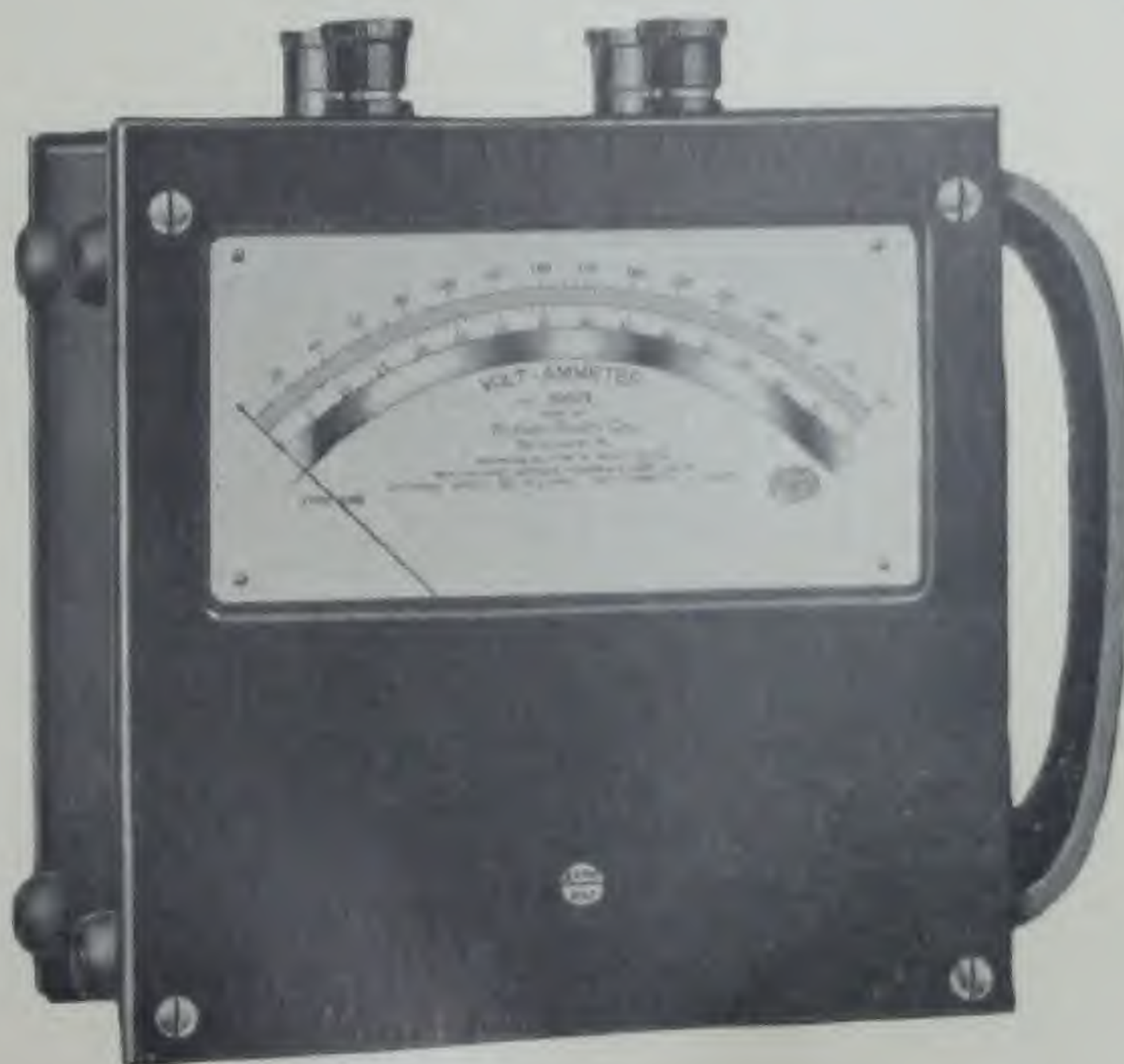


100 Ampere Type GSD Ammeter

This page and the two pages following cover our Type GSD Ammeters, Voltmeters and Volt-Ammeters. Dimensions are approximately 7x7x4½ inches. Average net weight is 8 pounds, shipping weight 17 pounds. Each instrument has mirror under scale to correct for parallax errors. A leather carrying handle is attached to the

case in a convenient position and the case is provided with rubber feet at the bottom.

For all around general service in industrial plants, laboratories, educational institutions and the like the GSD line meets the requirements for an accurate but rugged instrument. We recommend them unconditionally.



75 Ampere, 300 Volt Type GSD Volt-Ammeter

Type GSD Ammeters, Milli-ammeters Voltmeters and Milli-voltmeters For Direct Current

Cat. No.	Range	No. of Div.	Value per Division	List Price	Cat. No.	Range	No. of Div.	Value per Division	List Price
Milli-ammeters					Milli-voltmeters				
2120S	0-50 M. V. (with leads)	Ampere scale to suit shunt		\$54.00	2121S	0-10 M. V.	100	.1 M. V.	\$55.00
2139	0-5 M. A.	100	.05 M. A.	54.00	2122S	0-50	100	.5	51.00
2100	0-10	100	.1	55.00	2123S	0-100	100	1.	51.00
2140	0-15	150	.1	51.00	2124S	0-250	125	2.	51.00
2141	0-25	125	.2	51.00	2125S	0-500	100	5.	51.00
2101	0-50	100	.5	51.00	2126S	0-750	150	5.	51.00
2102	0-100	100	1.	51.00	Voltmeters				
2103	0-250	125	2.	51.00	2144S	0-1.5 V.	150	.01 V.	51.00
2104	0-500	100	5.	51.00	2127S	0-3	150	.02	51.00
2105	0-750	150	5.	51.00	2145S	0-10	100	.1	51.00
Ammeters					2128S	0-15	150	.1	51.00
2106	0-1 A.	100	.01 A.	51.00	2146S	0-25	125	.2	51.00
2142	0-1.5 A.	150	.01	51.00	2129S	0-50	100	.5	52.00
2143	0-3	150	.02	51.00	2147S	0-75	150	.5	54.00
2107S	0-5	100	.05	51.00	2130S	0-100	100	1.	54.00
2108S	0-10	100	.1	51.00	2131S	0-150	150	1.	58.00
2109S	0-15	150	.1	51.00	2132S	0-300	150	2.	64.00
2110S	0-25	125	.2	51.00	2133S	0-600	120	5.	70.00
2111	0-50	100	.5	52.00	2134S	0-750	150	5.	73.00
2112	0-75	150	.5	54.00	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> { 0-3 0-150 0-150 0-300 0-150 0-750 0-150 0-300 0-750 </div> <div> 150 150 150 150 150 150 150 150 150 </div> <div style="margin-right: 10px;"> .02 1. 1. 2. 1. 5. 1. 2. 5. </div> <div> } </div> </div>				
*2113S	0-100	100	1.	54.00					
*2114S	0-150	150	1.	55.00	2135S	0-150	150	1.	69.00
*2115S	0-200	100	2.	57.00	2136S	0-300	150	2.	74.00
*2116S	0-300	150	2.	58.00	2137S	0-750	150	5.	83.00
*2117S	0-400	80	5.	60.00	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> { 0-150 0-300 0-750 </div> <div> 150 150 150 </div> <div style="margin-right: 10px;"> 1. 2. 5. </div> <div> } </div> </div>				
*2118S	0-500	100	5.	63.00					
*2119S	0-750	150	5.	65.00	2138S	0-750	150	5.	93.00

*Supplied with separate 50 M. V. shunt and 6 ft. leads.

Center zero instruments can be supplied at the same list prices as the left zero ones. The value per division on center zero instruments is usually twice that of left zero instruments.

"S" indicates stock item.

For ammeters with ranges higher than those listed and for separate shunt ammeters in capacities of 75 amperes and less use a Cat. No. 2120 instrument with appropriate shunt as listed on page 14.

For ammeters with more than one range (†) add to the list price of a Cat. No. 2120 instrument the list prices of appropriate shunts. See page 14 for shunt listing.

For voltmeters with ranges higher than 750 volts use a voltmeter of any listed range selected with suitable external multiplier as listed on page 13.

For milli-ammeters, milli-voltmeters and voltmeters with two or three ranges (†) add to the list price of the highest priced range selected, \$10.00 for each additional range.

Differential voltmeters can be supplied at a list price of \$10.00 additional to the list price of the left zero instrument of similar range. Differential voltmeters being center zero instruments, the value per division is usually twice that of left zero instruments.

Differential voltmeters in standard form have a single winding with a tap taken from the middle point. There are three terminals, one terminal common to both halves of the winding. There are cases where it is impossible to use a common connection and, for these two separate windings, four terminals must be used. These two-winding, four terminal instruments are not standard and prices will be quoted on application.

†Note that only ranges with the same number of scale divisions can be combined.

In ordering specify catalog number, quantity, special features, if any, and range or ranges.

Type GSD Direct Current Volt-Ammeters

LIST PRICES

Milli-Volt Ranges	MILLI-AMPERE RANGES															0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-250	0-100	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25	0-15	0-10	0-5	0-3	0-1.5 Amps.	0-1 Amp.	0-750	0-500	0-400	0-300	0-200	0-150	0-100	0-75	0-50	0-25
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*Has separate 50 M. V. shunt and 6 ft. leads.
Values per scale division are the same as for corresponding voltmeters and ammeters. (See page 6.)
Volt-ammeters can be supplied with only one self-contained ampere range but with one, two or three milli-volt or volt ranges in addition to the ampere range. For two or three such ranges add \$10.00 list to highest list price involved for each added range. Only ranges having the same number of scale divisions can be combined.
Prices on instruments having ampere or volt ranges higher than those listed and on combinations not shown will be supplied on request.
In ordering specify catalog number, quantity, ranges and special features, if any.

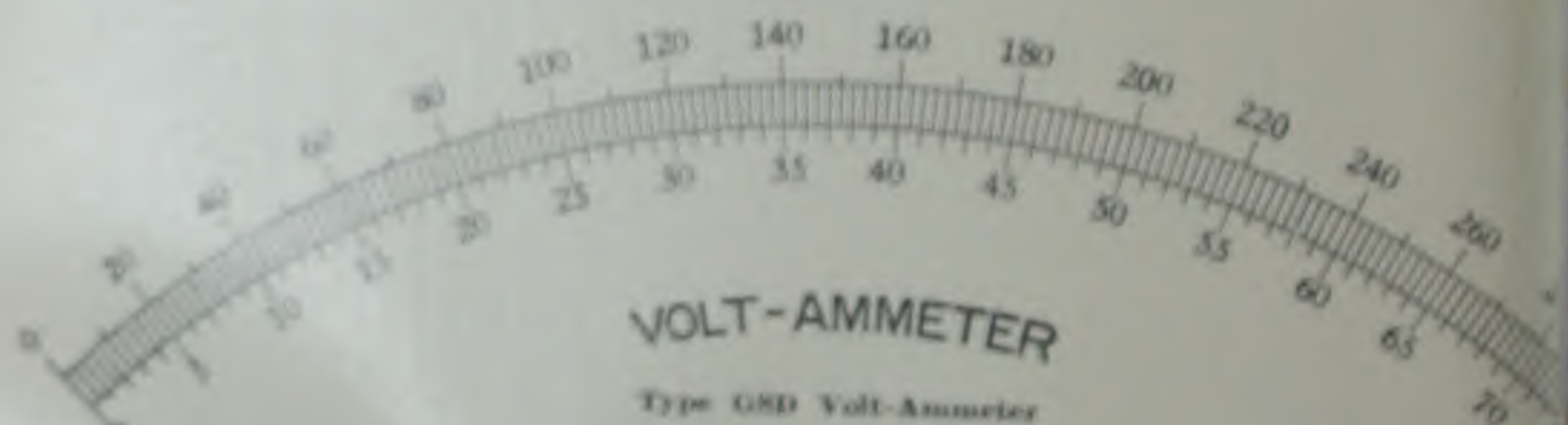
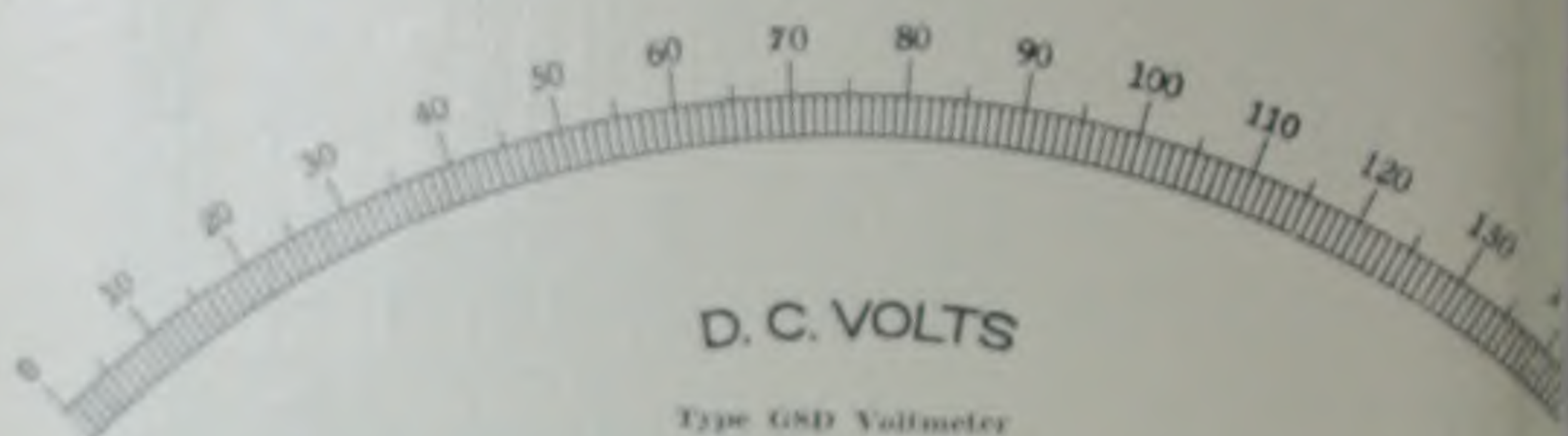
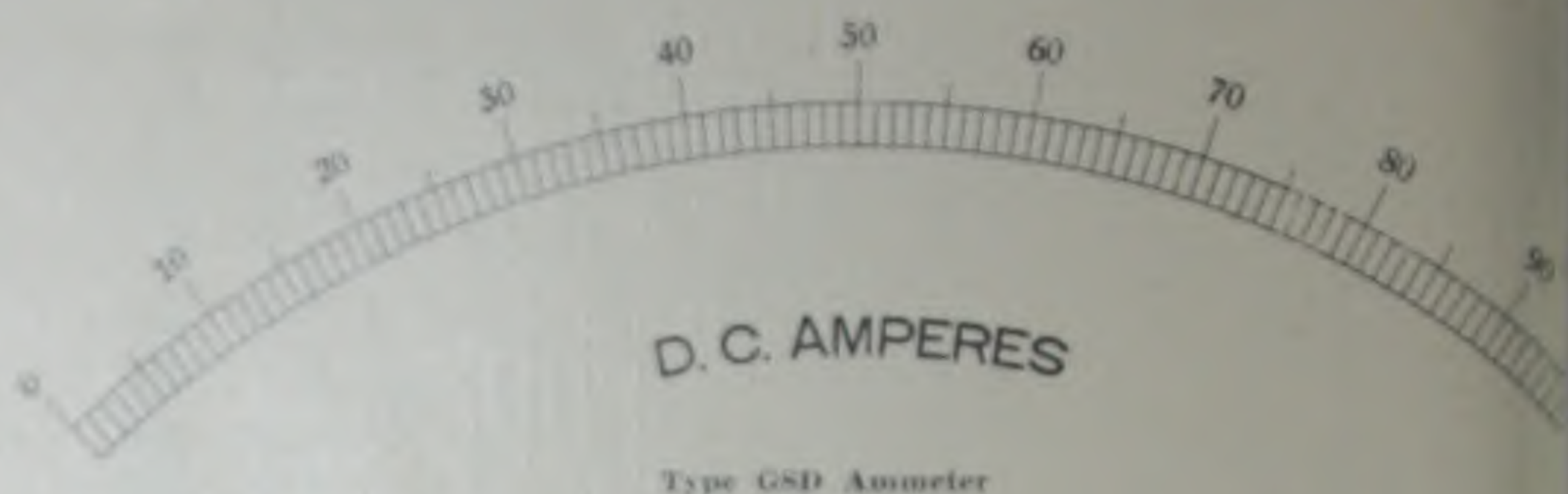
CIRCUIT
BREAKERS

RELAYS

FAC-SIMILE SCALES

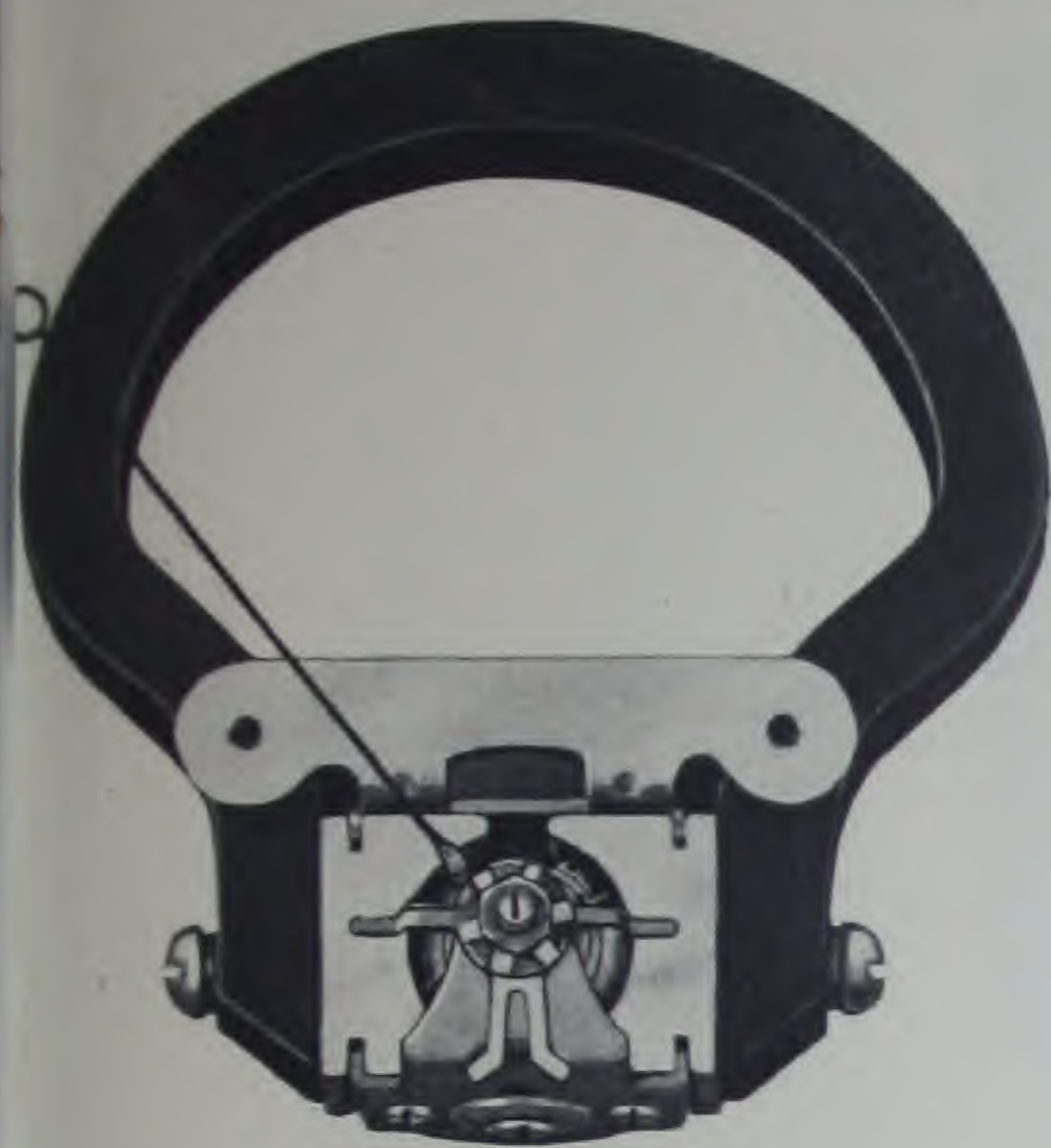
of Type GSD Direct Current Instruments

(Full Size)



Type HTD

Direct Current Portable Instruments



There is an ever-increasing demand for direct current measuring instruments smaller and less expensive than the regular run of portable devices that heretofore have been available.

Several years ago, the ROLLER-SMITH COMPANY put on the market its well-known Type HD instruments, large numbers of which have been sold and are giving 100% satisfaction. However, there has since come up a demand for a still smaller instrument, one which is truly of "pocket size."

To meet this demand, the ROLLER-SMITH COMPANY has developed and now offers the Type HTD direct current portables shown in this Bulletin, the HTD superseding the HD. The HTD is a real pocket port-

able and the prices are extremely low for such high quality instruments.

On this page we give the essential details that are common to all the HTD instruments in this Bulletin (except as noted).

The pleasing appearance of these instruments and the open, well-lighted and easily read scales are outstanding features.

Cases are light but rigid metal with black rubberoid finish. The cases are so constructed as to be practically dust proof and moisture proof and, if we are advised that the instruments are to be used in tropical countries or under humid conditions, additional precautions can be taken to exclude moisture and protect the dial.

Connections are in the form of binding posts with non-removable tops so arranged that the binding posts cannot turn.

The magnetic damping which is characteristic of the d'Arsonval type of mechanism insures "dead beat" action of the moving element.

Dials are pure white bristol-board of the highest grade and the scales are drawn in by hand in accordance with the characteristics of each instrument. Non-fading black India ink, which retains its legibility indefinitely, is used in all types.

All scales have uniform divisions.

Pointers are light but rigid aluminum.

Glasses are free from flaws and are firmly fastened in place.

All instruments are provided with a convenient and efficient zero adjuster.

Springs are of phosphor-bronze, well aged to minimize zero shifting.

Mechanisms are so mounted that the parts cannot get out of alignment.

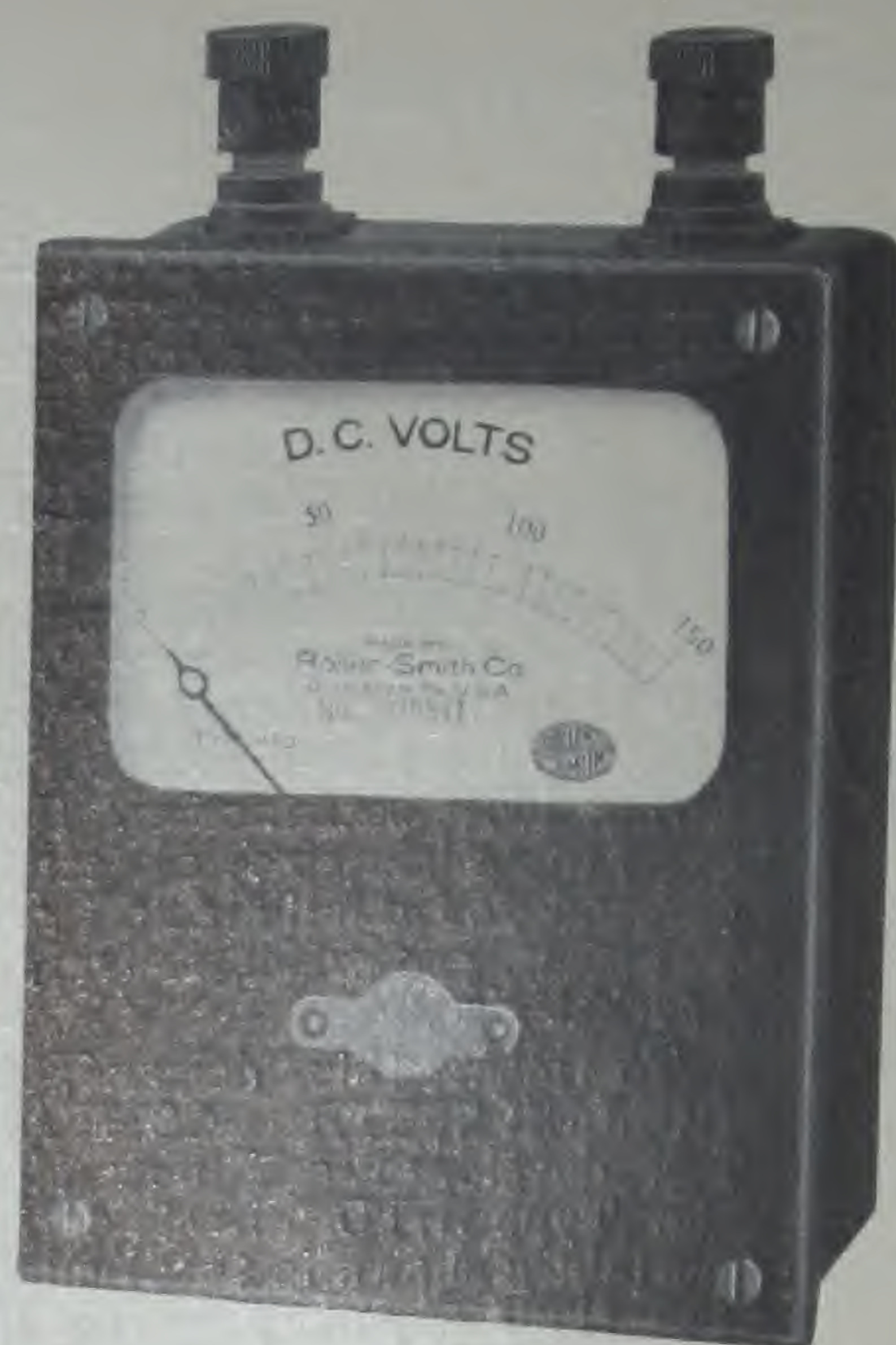
Mechanisms are of the permanent magnet, moving coil type as illustrated on this page.

All the instruments are accurate within 1% of full scale value.

Dimensions of the instruments are $3\frac{1}{2}$ " wide, $4\frac{1}{2}$ " high and $1\frac{1}{2}$ " deep, except for double range ammeters and triple range voltmeters and all volt-ammeters, which are $5\frac{1}{4}$ " high. Average net weight is 1 pound, 4 ounces and shipping weight 2 pounds, 4 ounces.

All scales are 2.1" long.

Other details not common to the Type HTD instruments will be found in the section devoted to each particular type.



Type HTD Direct Current

Ammeters and Milli-ammeters Voltsmeters and Milli-voltsmeters

Type HTD instruments are recommended particularly to electricians, linemen, testers, "trouble shooters," schools and colleges, garages, service stations and to all requiring small, accurate and inexpensive instruments. Though the instruments are small the scales are comparatively long and close readings can be taken. (See full size scales shown on page 13 of this Bulletin.)

Very high resistance voltmeters (about 1000 ohms per volt) for radio and other work can be supplied. See listings on this page in ranges in which they are available.

Center zero instruments can be supplied at the same list prices as left zero instruments. The value per scale division on center zero instruments is usually twice that of left zero instruments.

For double range voltmeters or double range self-contained ammeters add \$3.75 to list price of higher range; for triple range add \$10.00. In ordering instruments with more than one range select ranges having the same number of scale divisions, for example: 0-3 volts and 0-300 volts (both 30 divisions), list price \$23.00 plus \$3.75 or \$26.75 total.

Cat No. 12206 leather carrying case for use with any self-contained type HTD ammeter, voltmeter or volt-ammeter \$3.25 List

OTHER LEATHER CARRYING CASES—Prices on application.

Directions for ordering: Specify quantity and catalog number and if more than one range desired, what those ranges are.

"S" indicates stock item.

Cat. No.	Range	Value Per Scale Division	List Price
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MILLI-AMMETERS

1285	50 M. V. capacity with 3 ft. leads	Scale to Suit Shunt	\$20.25
1170	.5-0-.5 M. A.	.025 M. A.	26.00
1172	0-1	.025	26.00
1143	0- 5	.2	24.00
1145	0- 10	.25	20.00
1147	0- 15	.5	20.00
1149	0- 25	1.0	20.00
1100	0- 50	2.0	18.75
1102	0-100	2.5	18.75
1174	0-150	5.	18.75
1176	0-200	5.	18.75
1104	0-250	10.0	18.75
1178	0-300	10.	18.75
1180	0-400	10.	18.75
1106	0-500	20.0	18.75
1159	0-800	26.0	18.75

AMMETERS

1108	0- 1 A.	.025 A.	18.75
1151	0- 1.5	.05	18.75
1110	0- 3	.1	18.75
1112S	0- 5	.2	18.75
1114S	0- 10	.25	18.75
1116	0- 15	.5	18.75
1182	0- 20	.5	18.75
1120S	0- 30	1.0	19.50
1184	0- 40	1.0	19.50
1122S	0- 50	2.0	19.50
1186	0- 60	2.0	19.50
*1153S	0- 80	2.0	22.00
*1126S	0-100	2.5	23.50
*1128S	0-150	5.0	25.00
*1130S	0-200	5.0	26.50

MILLI-VOLTMETERS

1131S	0- 50 M. V.	2.0 M. V.	18.75
1129S	0-100	2.5	18.75
1136S	0-250	10.0	18.75
1138S	0-500	20.0	18.75

VOLTMETERS

1142S	0- 1.5 V.	.05 V.	18.75
1144S	0- 3	.1	18.75
1188S	0- 5	.2	18.75
1148S	0- 10	.25	18.75
1150S	0- 15	.5	18.75
1101S	0- 20	.5	18.75
1154S	0- 30	1.0	18.75
1156S	0- 50	2.0	19.50
1190S	0- 75	2.5	19.50
1155S	0- 80	2.0	19.50
1157S	0-100	2.5	20.00
1162S	0-150	5.0	20.50
1164S	0-250	10.0	22.50
1166S	0-300	10.0	23.00
1125S	{ 0-150 0-300	{ 5.0 10.0 }	26.75

HIGH RESISTANCE VOLTMETERS

1191	0- 50 V.	2.0 V.	35.00
1192	{ 0- 50 0-250	{ 2.0 10.0 }	42.25
1193	0-500	20.0	37.00
1194	{ 0- 50 0-500	{ 2.0 20.0 }	43.25
**1195	{ 0- 50 0-250 0-500	{ 2.0 10.0 20.0 }	62.00

* External 50 M. V. shunt and 3 ft. leads.
** Has external resistor for the 500 volt range.

Type HTD Direct Current Volt-Ammeters

The possible combinations of single ampere and single volt ranges with prices to apply are indicated in the table shown below.

For Volt-Ammeters with more than one volt and one ampere range see t page.

Milli-Volt Ranges	MILLI-AMPERE RANGES										AMPERE RANGES									
	0-5 M. A.	0-10	0-15	0-25	0-50	0-100	0-250	0-500	0-800	0-1 Amps.	0-1.5 Amps.	0-5	0-10	0-15	0-30	0-50	0-80	0-100	0-150	0-200
0-50 M. V.	30.00			27.25	26.25		26.25	26.25		26.25		26.25				28.00				
0-100		27.25				26.25			26.25				26.25				28.75	29.75		31.75
0-250	30.00			27.25	26.25		26.25	26.25				26.25				28.00				
0-500	30.00			27.25	26.25		26.25	26.25				26.25				28.00				
Volt Ranges 0-1.5 Volts			27.25							26.25	26.25	26.25		26.25	28.00				30.75	
			27.25							26.25	26.25	26.25		26.25	28.00				30.75	
		27.25				26.25			26.25			26.25					28.75	29.75		31.75
			27.25			26.25			26.25			26.25					28.75	29.75		31.75
		27.25				26.25			26.25			26.25					28.75	29.75		31.75
			27.25			26.25			26.25			26.25					28.75	29.75		31.75
		27.25				26.25			26.25			26.25					28.75	29.75		31.75
			27.25			26.25			26.25			26.25					28.75	29.75		31.75
		27.25				26.25			26.25			26.25					28.75	29.75		31.75
			27.25			26.25			26.25			26.25					28.75	29.75		31.75
0-1000		28.00				27.00			27.00			27.00					29.25			32.25
0-1500			28.00			27.00			27.00			27.00					29.25	30.25		32.75
0-2500	33.50		28.00		28.75		28.75	28.75		27.50	27.50	28.75			28.00	29.25			33.25	
0-3000			30.25							29.25	29.25			29.25	29.75				43.25	
No. of Scale Divisions	25	50	100	25	25	40	25	25	40	60	30	25	40	50	50	25	40	40	30	40

* External 50 M. V. shunt and 3 1/2 leads.

† External resistor.

Type HTD Direct Current Volt-Ammeters

With TWO ampere and TWO volt ranges

Any two of the volt ranges listed in this column and Any two of the ampere ranges listed in this column

25 Division Scales

Range	Value Per Division	Range	Value Per Division
0- 50 M.V.	2.0 M.V.	0- 5 M.A.	.2 M.A.
0-250	10.0	0- 25	1.0
0-500	20.0	0- 50	2.0
0- 50 Volts	2.0 Volts	0-250	10.0
†0-250	10.0	0-500	20.0
		0- 5 Amperes	.2 Ampere
		0- 50	2.0 Amperes

30 Division Scales

Range	Value Per Division	Range	Value Per Division
0- 1.5 Volts	.05 Volt	0- 15 M.A.	.5 M.A.
0- 3	.1	0- 1.5 Amperes	.05 Ampere
0- 15	.5	0- 3	.1
0- 30	1.0	0- 15	.5
0-150	5.0 Volts	0- 30	1.0
†0-300	10.0	*0-150	5.0 Amps.

40 Division Scales

Range	Value Per Division	Range	Value Per Division
0-100 M.V.	2.5 M.V.	0- 10 M.A.	.25 M.A.
0- 10 Volts	.25 Volt	0-100	2.5
0- 20	.5	0- 1 Ampere	.025 Ampere
0- 80	2.0 Volts	0- 10 Amperes	.25
0-100	2.5	*0- 80	2.0 Amps.
		*0-100	2.5
		*0-200	5.0

† External resistor

* External 50 M. V. shunt and 3 ft. leads

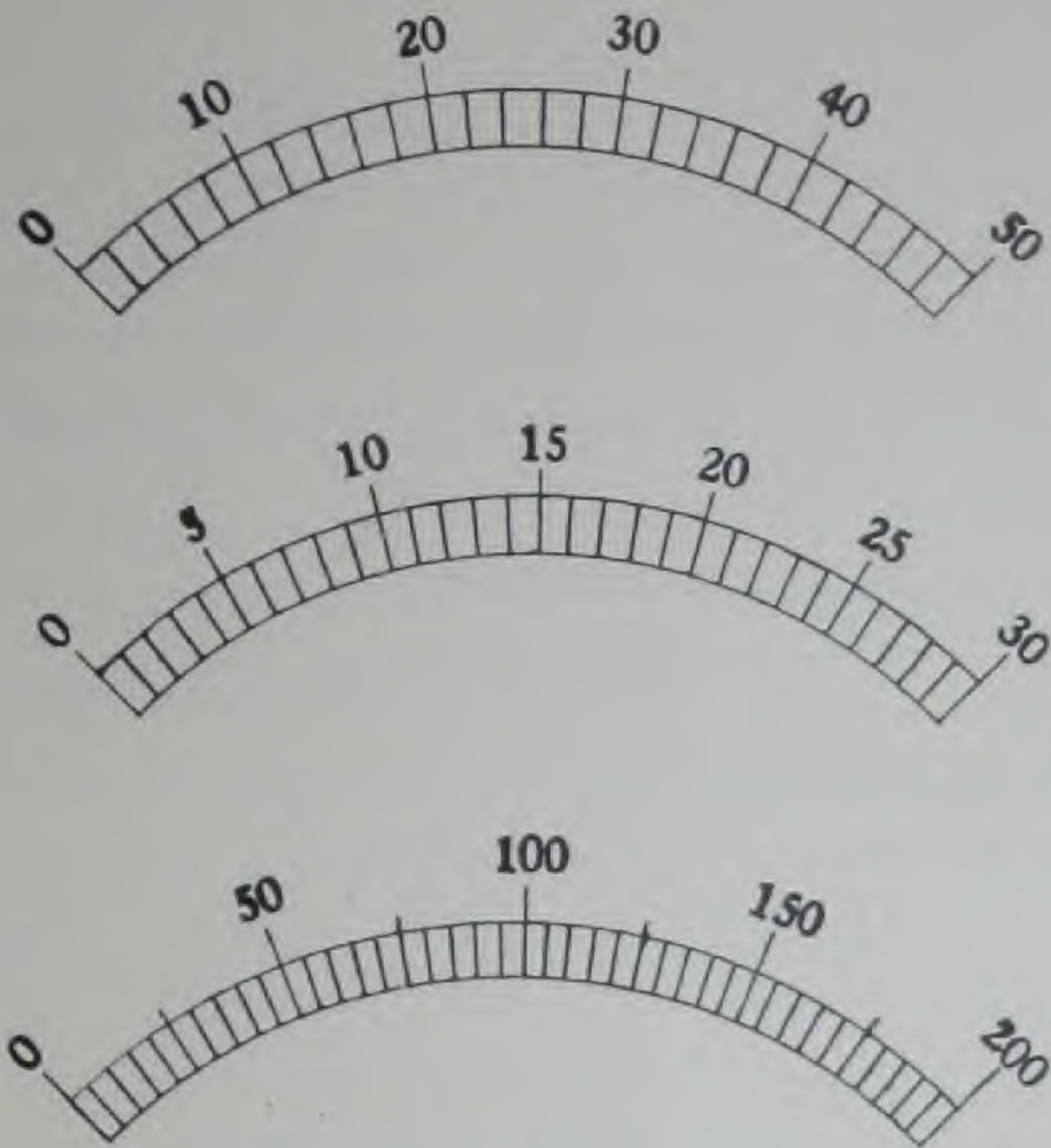
Where the higher voltage range is 150 volts or under and the higher ampere range 50 amperes or under, the list price is.....\$34.75

Where the higher voltage range is in excess of 150 volts and the higher ampere range is 50 amperes or under, the list price is..... 38.50

Where the higher voltage range is 150 volts or under and the higher ampere range is in excess of 50 amperes, the list price is..... 38.50

Where the higher voltage range is in excess of 150 volts and the higher ampere range is in excess of 50 amperes, the list price is..... 41.75

Type HTD Fac-Simile Scales
(Full Size)



Type GSD Shunts

50 M. V., for ammeters or volt-ammeters

Separate shunts for ammeters and volt-ammeters can be supplied at the following list prices:

Cat. No.	Ampere Capacity	List Price	Cat. No.	Ampere Capacity	List Price
2150S	1	\$7.00	2159S	200	\$7.00
2148	1.5	7.00	2160S	300	7.75
2149	3	7.00	2161	400	8.25
2151	5	7.00	2162S	500	10.75
2152S	10	7.00	2163S	750	15.25
2153	15	7.00	2164S	1000	18.00
2154S	25	7.00	2169	1200	20.00
2155	50	7.00	2165	1500	34.00
2156S	75	7.00	2166S	2000	43.50
2157	100	7.00	2167	2500	47.50
2158S	150	7.00	2168	3000	52.25

In ordering specify quantity and catalog number.

Prices on shunts of ampere capacities higher than 3000 amperes will be quoted on request.

Type GSD 50 M. V. shunts are used with Type GSD ammeters and Type HTD ammeters, listed in this Bulletin.

"S" indicates stock item.

Alternating Current Portable Instruments

Roller-Smith Bulletin No. 160 covers a complete line of alternating current ammeters, voltmeters and A. C. single phase and D. C. wattmeters. This line of instruments, known as the Types GSA and HTA, are similar, as far as case styles and sizes are concerned, to the Types GSD and HTD line listed in this Bulletin. A copy of Bulletin No. 160 covering the HTA and GSA lines will gladly be sent to anyone on request.

CIRCUIT
BREAKERS

RELAYS

Type GS Multipliers

These are used to increase the voltage capacities of voltmeters and indicating wattmeters, both A. C. and D. C., and consist of non-inductively wound resistances of appropriate values with suitable containing cases. A multiplier is used by connecting it in series with the voltage winding of the instrument and enables the instrument to be used on a higher voltage.

Each multiplier must be adjusted for use with its own particular instrument and, hence, multipliers are not interchangeable.

When ordered for use with a multiple range or capacity instrument, the multiplier is always arranged for use with the highest range or capacity of the instrument.

Cat. No.	Voltage Range of Instrument		Ratio	List Price
	Without Multiplier	With Multiplier		
*2380	3 Volts	150 Volts	50 to 1	\$25.00
*2381	3 "	300 "	100 " 1	27.50
*2382	3 "	600 "	200 " 1	32.50
*2383	3 "	750 "	250 " 1	35.00
*2384	15 "	150 "	10 " 1	25.00
*2385	15 "	300 "	20 " 1	27.50
*2386	15 "	600 "	40 " 1	32.50
*2387	15 "	750 "	50 " 1	35.00
2388	50 "	100 "	2 " 1	25.00
2389	50 "	750 "	15 " 1	35.00
2390	150 "	300 "	2 " 1	25.00
2391	150 "	600 "	4 " 1	30.00
2392	150 "	750 "	5 " 1	32.50
2393	300 "	600 "	2 " 1	27.50
2394	750 "	1500 "	2 " 1	45.00
2395	750 "	3000 "	4 " 1	60.00

*For voltmeters only.

These multipliers can be supplied with taps for intermediate voltages at an extra cost of \$5.00 list per tap. For example, assume a 15 volt voltmeter and a multiplier with three taps is wanted to increase the range respectively to 150, 300 and 600 volts, i.e., with three ratios, namely, 10 to 1, 20 to 1, and 40 to 1. Such a multiplier lists at \$32.50 for the 15 to 600 volt (40 to 1) multiplier, plus \$5.00 for the 300 volt tap and plus \$5.00 for the 150 volt tap or a total of \$42.50.

In ordering specify catalog number of multiplier and serial number of instrument for which multiplier is to be adjusted.

Types KGD and LGD Galvanometers

The instruments shown on this page were designed with the particular requirements of educational institutions and laboratories in mind. These galvanometers will also be of interest to anyone who is concerned in electrical measurements involving the use of a bridge network.

Galvanometers should possess the requisite accuracy and sensitivity, but should also be sufficiently rugged and sturdy to stand considerable abuse. In electrical measurements involving the attainment of a zero balance the conditions are frequently such, that, seeking for zero quite often subjects the galvanometer to high overloads and sudden violent deflections of the pointer.

With these conditions in mind, the ROLLER-SMITH COMPANY has developed and now offers two different types of galvanometers, one or the other of which will be found to meet practically any requirement.

The design and construction of these galvanometers have been worked out with the greatest care and the result is one of which the ROLLER-SMITH COMPANY is justly proud.

These instruments are offered with the assurance that every detail of design and workmanship is up to the exacting standard which the ROLLER-SMITH COMPANY has constantly before it.

TYPE KGD GALVANOMETERS

Our Student's Type KGD galvanometers are offered to meet the demand for reasonably priced instruments and are particularly recommended for use in educational institutions and laboratories where a sensitive but very rugged device is wanted.

The case is polished black walnut with highly finished hard rubber top. The binding posts have non-removable tops. A zero adjuster is conveniently located on the front of the case. The dial is pure white bristol-board. A knife-edge pointer is provided. The scale divisions are uniform with 5 divisions on both sides of zero. The instrument is well damped.

The current value of the Type KGD galvanometer scale is 16 micro-amperes per millimeter. The resistance is about 75 ohms.

The net weight is 1 3/4 lbs. Overall dimensions are approximately 5 1/2 in. long by 3 1/2 in. wide by 3 5/8 in. high.



Type LGD Galvanometer

Cat. No.	Description	List Price
100S	Type KGD galvanometer	\$40.00

In ordering specify quantity and catalog number.

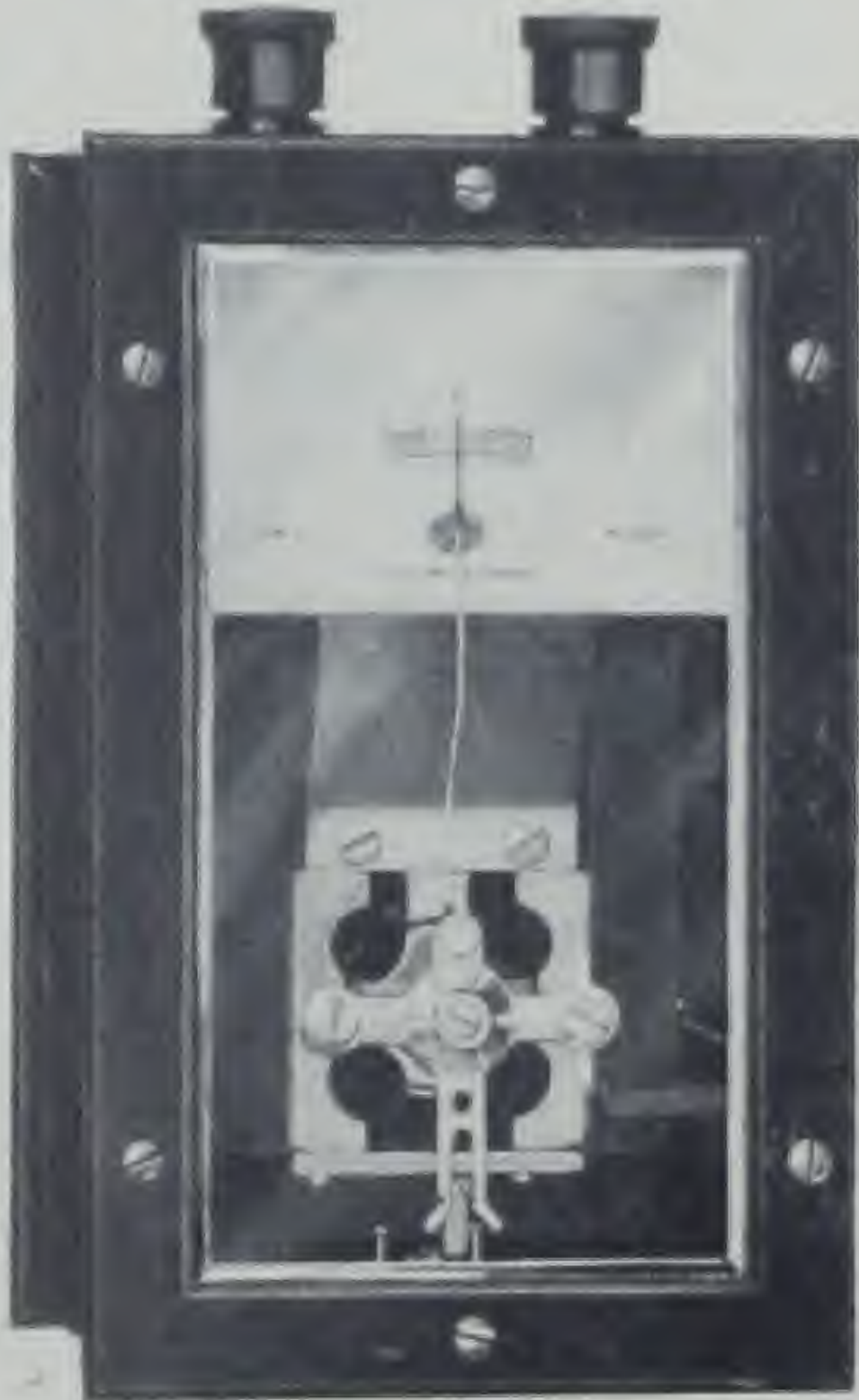
TYPE LGD GALVANOMETERS

Our Type LGD galvanometer is intended for all applications where an instrument of high sensitivity, great accuracy and extreme ruggedness is wanted. No expense has been spared in perfecting this galvanometer and the highest grade of workmanship and materials is used throughout. Following are the details:

The case is selected, beautifully finished black walnut with heavy beveled plate glass front, which affords a complete view of the mechanism. All the interior parts are highly finished. The binding posts are of the non-removable top type attached to the end of the case. A zero adjuster is conveniently located on the end of the case and the pointer can easily be adjusted to zero. The dial is pure white bristol-board. The pointer is of the knife-edge type. The scale divisions are uniform with 10 divisions on both sides of zero. These instruments are exceedingly well damped, which insures quick readings.

The current value of the Type LGD galvanometer scale is 2 micro-amperes per millimeter. The resistance is about 275 ohms.

The net weight is 4 lbs. Overall dimensions are 7 1/4 inches long by 4 1/4 inches wide by 3 3/4 inches high.



Type KGD Galvanometer

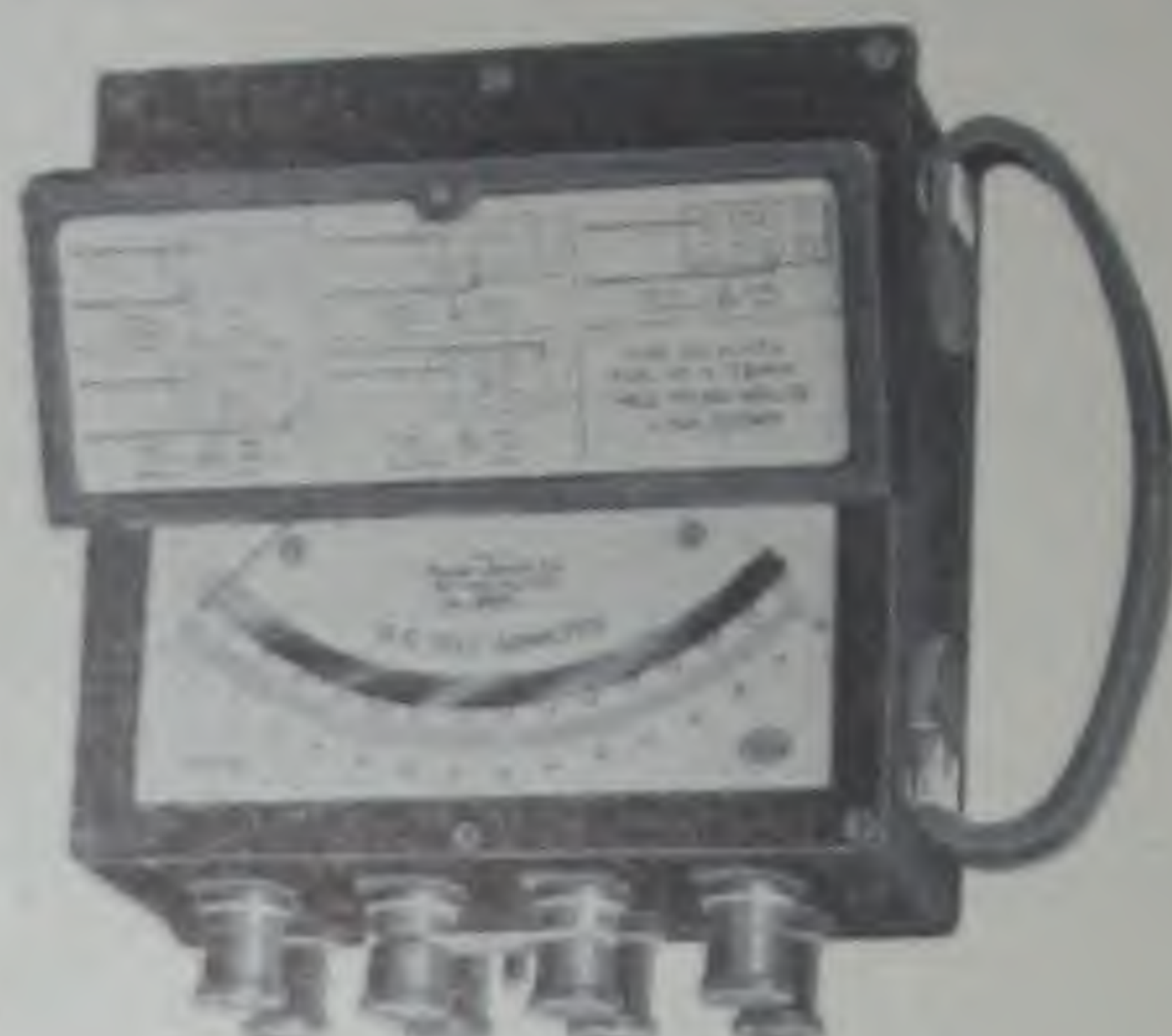
Cat. No.	Description	List Price
102	Type LGD galvanometer	\$70.00

In ordering specify quantity and catalog number.

CIRCUIT BREAKERS

RELAYS

Direct Current Type ISD Volt-Ammeters



Cat. No. 1008
Dimensions, $6\frac{1}{2} \times 6\frac{1}{4} \times 4$ inches;
weight 8 pounds

The Type ISD volt-ammeter was designed originally with the particular requirements of railway signal engineers and supervisors in mind, but it has since found great favor wherever a large number of ranges has to be combined in a single instrument of high accuracy. The various ranges which are incorporated provide means for the great variety of tests which have to be made. For direct current testing it has no equal.

The mechanism is an improved d'Arsonval type, insuring uniform scale divisions and dead beat indications. Ruggedness has not been sacrificed and experience has shown that these instruments will continue to give good service even under the severe conditions which are frequently encountered. Case is a solid aluminum structure, black enamel finish with triple-hinged cover, snap catch and stout leather handle. The case is so designed that it is *dust* and *water-proof*. Binding posts are very heavy, as may be seen, have non-removable tops and are plainly marked with numerals indicating scale value obtained when said binding post is employed. A zero adjuster of convenient and efficient design is incorporated. Scales are hand calibrated and dials are not affected by moisture or by changes in temperature. Accuracy

is within $\frac{1}{2}$ of 1% of full scale value at any point on the scale. Scales are $5\frac{1}{4}$ " long.

It will be noted that in the connections are shown diagrams of connections for the various ranges. This is a great convenience as it enables proper connections being made quickly.

The instrument is entirely self-contained, there being no external multipliers or shunts.

We invite correspondence regarding special combinations not listed.

PRICE LIST

Cat. No.	RANGES	Value per Scale Division	List Price
*1000 S	0- 3. Volts 0- 30. " " 0- .150 Amp. 0- 1.5 Amps. 0- 15. " "	.02 Volt .2 " " .001 Amp. .01 " " .1 " "	\$100
*1001 S	0- 3. Volts 0- 30. " " 0- 150. " " 0- .150 Amp. 0- 1.5 Amps. 0- 15. " "	.02 Volt .2 " " 1. " " .001 Amp. .01 " " .1 " "	115
*1002 S	0- 3. Volts 0- 30. " " 0- 300. " " 0- .150 Amp. 0- 1.5 Amps. 0- 15. " "	.02 Volt .2 " " 2. Volts .001 Amp. .01 " " .1 " "	130
1008 S	0- 3. Volts 0- 30. " " 0- .03 Amp. 0- .3 " " 0- 3. Amps. 0- 30. " "	.02 Volt .2 " " .0002 Amp. .002 " " .02 " " .2 " "	115.00
*1010	0- 3. Volts 0- 15. " " 0- 150. " " 0- .150 Amp. 0- 1.5 Amps. 0- 15. " "	.02 Volt .1 " " 1. " " .001 Amp. .01 " " .1 " "	115.00
*1014	0- 1.5 Volts 0- 15. " " 0- 150. " " 0- .15 Amp. 0- 1.5 Amps. 0- 15. " "	.01 Volt .1 " " 1. " " .001 Amp. .01 " " .1 " "	115.00

* An additional range of 150 amperes may be supplied at an extra list charge of \$20.00. The 150 ampere shunt is self-contained but mounted on the outside instead of the inside of the case.

"S" indicates stock item.

Cat. No. 1008 is A.R.A. combination No. 1.

Cat. No. 1010 is A.R.A. combination No. 2.

Directions for Ordering: Specify quantity and catalog number.

Direct Current Type HSD Volt-Ammeters



Cat. No. 1003

Dimensions, 5 x 4 x 2 inches; weight 20 ounces

For maintenance work and general engineering where low cost and lightness are the chief considerations, we recommend the Type HSD Volt-Ammeter which may be procured in combinations including as high as three volts and three current ranges.

The mechanism is of the d'Arson-type of a smaller form than the one used in the larger Type ISD instrument. The scales have hair line divisions, are hand calibrated and hand drawn, all of which combine to give very accurate readings. Scales are 2.6" long. Dials are not affected by moisture or by changes in temperature. Accuracy is within 1½% of scale value at any point on the scale. The case and base are of metal with a baked-on black enamel finish. The top is of waterproof construction. The bottom of the base is secured with bakelite plate for insulation purposes. Binding posts are of the non-removable top type, hard rubber being employed for the voltmeter ranges and polished nickel for the ammeter ranges. A switch of special design is incorporated in the instrument which allows momentary readings to be taken or it may be locked for continuous readings. A zero adjuster is provided which can be manipulated from the front of the instrument as shown on the above illustration.

The general design of the instrument has been worked out with the idea of obtaining maximum ruggedness. The heavy metal case is so proportioned as to provide the greatest protection for the mechanism. The heavy raised bezel surrounding the front gives additional strength to the top and will sustain the weight of an average man without damage to the instrument. The very widespread use of these instruments on railroads throughout the entire United States and foreign countries and the almost total absence of trouble experienced enables us to recommend them as the most rugged type of instrument that it is possible to build.

We invite correspondence regarding special combinations not listed.

PRICE LIST

Cat. No.	RANGES	Value per Scale Division	List Price
1003 S	0- 3. Volts	.05 Volt	\$40.00
	0- 30. "	.5 "	
	0- .6 Amp.	.01 Amp.	
	0- 6. Amps.	.1 "	
†† 1012	0- 3. Volts	.05 Volt	40.00
	0- 30. "	.5 "	
	0- .3 Amp.	.005 Amp.	
	0- 6. Amps.	.1 "	
1020	0- 3. Volts	.05 Volt	47.50
	0- 30. "	.5 "	
	0-150. "	2.5 Volts	
	0- .150 Amp.	.0025 Amp.	
	0- 1.5 Amps.	.025 "	
	0- 15. "	.25 "	
** 1024	0- 3. Volts	.05 Volt	47.50
	0- 30. "	.5 "	
	0- .03 Amp.	.0005 Amp.	
	0- .3 "	.005 "	
	0- 3. Amps.	.05 "	
	0- 30. "	.5 "	
†1026 S	0- 3. Volts	.05 Volt	47.50
	0- 15. "	.25 "	
	0-150. "	2.5 Volts	
	0- .150 Amp.	.0025 Amp.	
	0- 1.5 Amps.	.025 "	
	0- 15. "	.25 "	
1007 S	0- 1.5 Volts	.025 Volt	47.50
	0- 15. "	.25 "	
	0-150. "	2.5 Volts	
	0- .150 Amp.	.0025 Amp.	
	0- 1.5 Amps.	.025 "	
	0- 15. "	.25 "	

Cat. No. 3151 leather carrying case for self-contained Type HSD instruments, \$6.50 Net.

"S" indicates stock item.

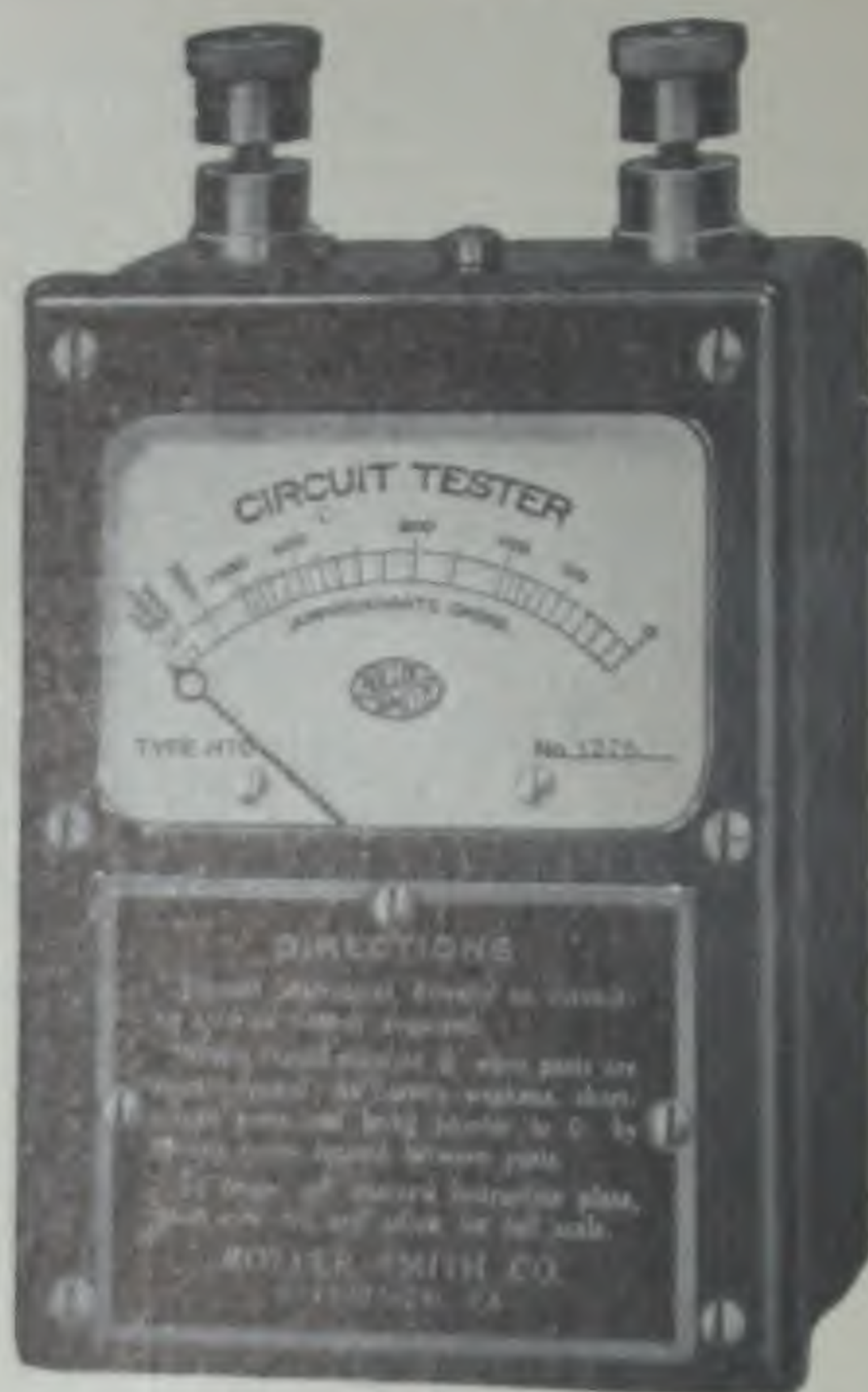
** A.R.A. combination No. 1.

† A.R.A. combination No. 2.

†† A.R.A. combination No. 3

Directions for Ordering: Specify quantity and catalog number.

Portable, Direct Reading Type HTD Circuit Tester



Cat. No. 3009 Type HTD Circuit Tester

USES

The uses of the HTD Circuit Tester are two-fold. The instrument can be used to ascertain if there is an electrical circuit existing between conductors applied to the terminals of the instrument and, secondly, it enables the user to read the resistance of the circuit under test. The HTD Circuit Tester is recommended for use in preference to magnetos and A.C. bell-ringing devices because of its accuracy of indications under all conditions and its lightness and compactness as well. The instrument measures $4\frac{1}{2}'' \times 3'' \times 1\frac{1}{2}''$, which dimensions are obviously much less than those of the conventional magneto outfit. Likewise, its light weight of 19 ounces commends it when compared with the bulkier and heavier magnetos. Indications on the HTD Circuit Tester are never misleading, whereas, the alternating current generated by the hand driven magnetos will often cause the bell to ring when circuits include condensers, even though the circuit itself is not complete. Likewise with magnetos testing the accumulative leakages in wiring encased in metal conduit will indicate that the circuit is complete, because of the condenser action, while actually the circuit is

open. With the HTD Circuit Test inductance or capacity in the circuit under test have no effect on the readings. The instrument is recommended particularly for use by wiremen, repairmen, and on coil and other electrical work which necessitates identification and checking up of various circuits. It may be carried in the pocket and conveniently be used when working on ladders or in places difficult of access.

GENERAL DESCRIPTION

This instrument consists of a small high grade d'Arsenval type D.C. voltmeter (our TD mechanism) connected in series with a small dry cell. The circuit is such that when the terminals of the instrument are connected the circuit is completed. The instrument pointer will indicate full scale when the terminals are short circuited.

SCALE

The scale reads directly in ohms which enables resistance readings of the circuit under test.

CASE

The instrument is enclosed in a heavy sheet metal case with black finish and is equipped with nickel-plated binding posts. An etched metal instruction plate is attached to the front of the instrument, giving instructions regarding replacement of the battery and the checking of the calibration. Removal of three screws the instruction plate can be taken off and the dry cell rendered accessible for replacement. The removal of this plate also gives access to the internal zero adjuster.

BATTERY

A standard flash light battery, 1" diameter by $1\frac{3}{8}''$ long, is employed in the Cat. Nos. 3009 and 3011. The Cat. No. 3013 takes a 3 volt "vest pocket" type flash light battery. These cells can be bought everywhere. Because of the low current consumption of the instrument the battery should give service for many months. From time to time the condition of the battery can be determined by short-circuiting the terminal posts, which should give full scale deflection of the pointer. An adjusting screw is provided whereby falling off in battery voltage can be compensated for up to the point of practical exhaustion of the cell.

(See page 19 for listing)

LEADS

The Cat. No. 3010 leads are for universal testing. They are about 50" long. One lead has a spade terminal on one end and a Mueller clip on the other end. The second lead has a spade terminal on one end and a 3½" prod on the other end.

The Cat. No. 3012 leads are for continuity testing of radio receiving sets. They are about 50" long. Both leads have a spade terminal at one end and a ½" insulated prod on the other end.

Cat. No.	Listing	List Price
09S	Type HTD Circuit Tester, 10,000 ohms.....	\$21.00
11S	Type HTD Circuit Tester, 100,000 ohms.....	25.00
13S	Type HTD Circuit Tester, 200,000 ohms.....	26.00
10S	Leads for universal testing; for use with Cat. No. 3009 Type HTD Circuit Tester	2.85
12S	Leads for testing continuity of radio receiving sets; for use with Cat. Nos. 3011 and 3013 Type HTD Circuit Testers.....	2.85
206S	Leather Carrying case; for use with Cat. Nos. 3009, 3011 or 3013 Type HTD Circuit Testers	3.25

"S" Indicates stock item.

Directions for Ordering:—Specify quantity and catalog number.

ROLLER-SMITH PRODUCTS

ROLLER-SMITH products comprise complete lines of electrical measuring instruments, relays and circuit breakers. Bulletins covering the various devices will be sent promptly on request.

SWITCHBOARD INSTRUMENTS

C. Ammeters, Voltmeters and Volt-Ammeters, 3½" and 4" sizes	Bulletin No. 400
C. Ammeters, Voltmeters and Wattmeters, 3½" and 4" sizes	" " 420
C. Ammeters and Voltmeters, large sizes.....	" " 430
C. Ammeters, Voltmeters, Wattmeters, Power Factor Meters, Frequency Meters, large sizes; Triplex Ammeters	" " 450
Radio Frequency Ammeters, all sizes.....	" " 810

PORTABLE INSTRUMENTS

C. and D. C. Ammeters, Voltmeters and Volt-Ammeters; Ohmmeters and Circuit Testers for signal system and train control apparatus testing.....	Bulletin No. 100
C. Ammeters, Voltmeters, Volt-Ammeters, Wattmeters, Frequency Meters and Power Factor Meters, large and small sizes	" " 160
Oil Bond Testers.....	" " 200
C. Ammeters, Voltmeters, Volt-Ammeters and Galvanometers, large and small sizes.....	" " 210
Precision Torsion Balances for weighing lamp filaments and other small bodies.....	" " 240
Ohmmeters and Circuit Testers	" " 300

INSTRUMENT TRANSFORMERS

Portable types	Bulletin No. 160
Switchboard types	" " 450

AIR CIRCUIT BREAKERS

C. and D. C., Industrial Type, all styles of trips, 100 amperes and less	Bulletin No. 520
C. and D. C., Standard Type, all styles of trips, all ampere capacities	" " 530
C. and D. C., Enclosed Type, 800 amperes and less.....	" " 580

OIL CIRCUIT BREAKERS

100 to 2,000 Amps., 2,500 to 15,000 Volts.....	Bulletin No. 600
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RELAYS

C. Relays, reverse current, etc.....	Bulletin No. 550
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ROLLER-SMITH Products comprise complete lines of Electrical Instruments, indicating and graphic, Relays and air and oil Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Representatives

Sales Offices

ATLANTA	101 Marietta Street	NEW YORK	233 Broadway
BOSTON	88 Broad Street	NEW ORLEANS	Masonic Temple
BUFFALO	Ellicott Square Building	OMAHA	W. O. W. Building
CHICAGO	53 W. Jackson Blvd.	PHILADELPHIA	Otis Building
CLEVELAND	1988 E. 66th Street	PITTSBURGH	First Nat. Bank Bldg.
DENVER	Kittridge Bldg.	ST. LOUIS	Natl. Bk. of Com. Bldg.
DETROIT	Fisher Building	ST. PAUL	Pioneer Building
HOUSTON	1006 Washington Avenue	SAN FRANCISCO	163-2nd Street
LOS ANGELES	912 E. Third Street	SEATTLE	Alaska Bldg.
MONTREAL	Tramway Bldg.	TORONTO	183 George Street

A B R O A D

THRALL ELECTRIC COMPANY	Box 2049, Havana, Cuba
DUVAL TRADING CO.	Kembla Bldgs., Sydney, Australia
ASHIDA ENGINEERING CO.	Daini, Osaka, Japan
MANILA MACHINERY & SUPPLY CO., INC.,	Box 607, Manila, Philippine Islands



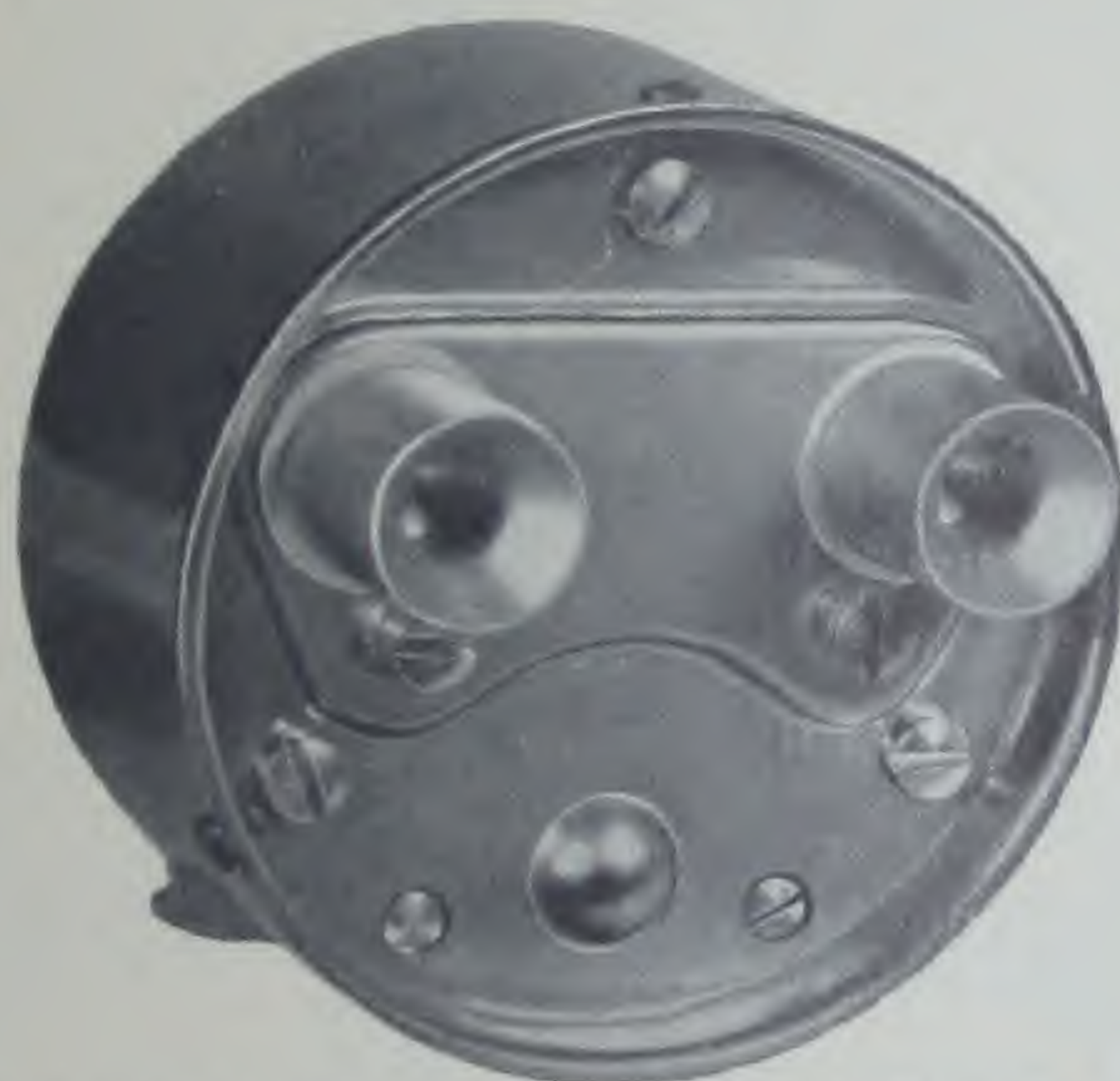


SUPPLEMENT No. 2
to Bulletin No. 210
April, 1930

Type BME Tester For No. 6 Dry Cells



Tester in Use



Rear View of Tester Showing Convenient Cup-shaped Terminals

ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

*Offices in Principal Cities in United States and Canada
Representatives in Australia, Cuba, Japan and Philippine Islands*

ROLLER-SMITH Type BME Tester For No. 6 Dry Cells

There has long been felt the need of an instrument with which the condition of dry cells could be ascertained quickly in order that dead or nearly dead cells could be eliminated from groups. Also in the selection of cells from a stock it is important to be able to quickly spot any that are not in good condition. Even unused cells in stock do deteriorate and the need of a check, before selling them to the user or putting them in service, is well understood.

The Type BME Cell Tester is an instrument offered to meet the special requirements of this field. It does not show voltage or the current in amperes flowing when applied to a cell, but gives, instead, a reading which shows the relative condition of the cell at the time.

As is generally known there are two common methods used in checking up dry cells, neither of which is satisfactory. They are

- (1) The voltage check with a voltmeter.
- (2) The current check with an ammeter.

A voltage check does not reveal the true condition of a cell since the voltage will remain up nearly at its maximum during a period when practically no current can be delivered.

The ammeter test, while helpful short circuits the battery and every test made, therefore, shortens the life of the cell tremendously. Both of these tests have also the added disadvantage that the user must have some knowledge of cell characteristics. Otherwise the readings are more misleading than helpful. The Type BME Tester does not make a dead short circuit on a cell, as in the case of an ammeter which allows 30 amperes or more to flow, but draws only 6 amperes from a new No. 6 cell.

The BME Tester has been designed to make possible the rapid testing of cells without the need of any special knowledge on the part of the user.

The instrument is built without polarity so that no time need be lost in reversing connections as is the case with the majority of battery instruments in use.

The terminals are spaced so as to fit directly over the terminals of a No. 6 standard cell.

The BME Tester is read by looking directly down upon the top of it, the natural way to read an instrument applied to the top of a No. 6 dry cell.

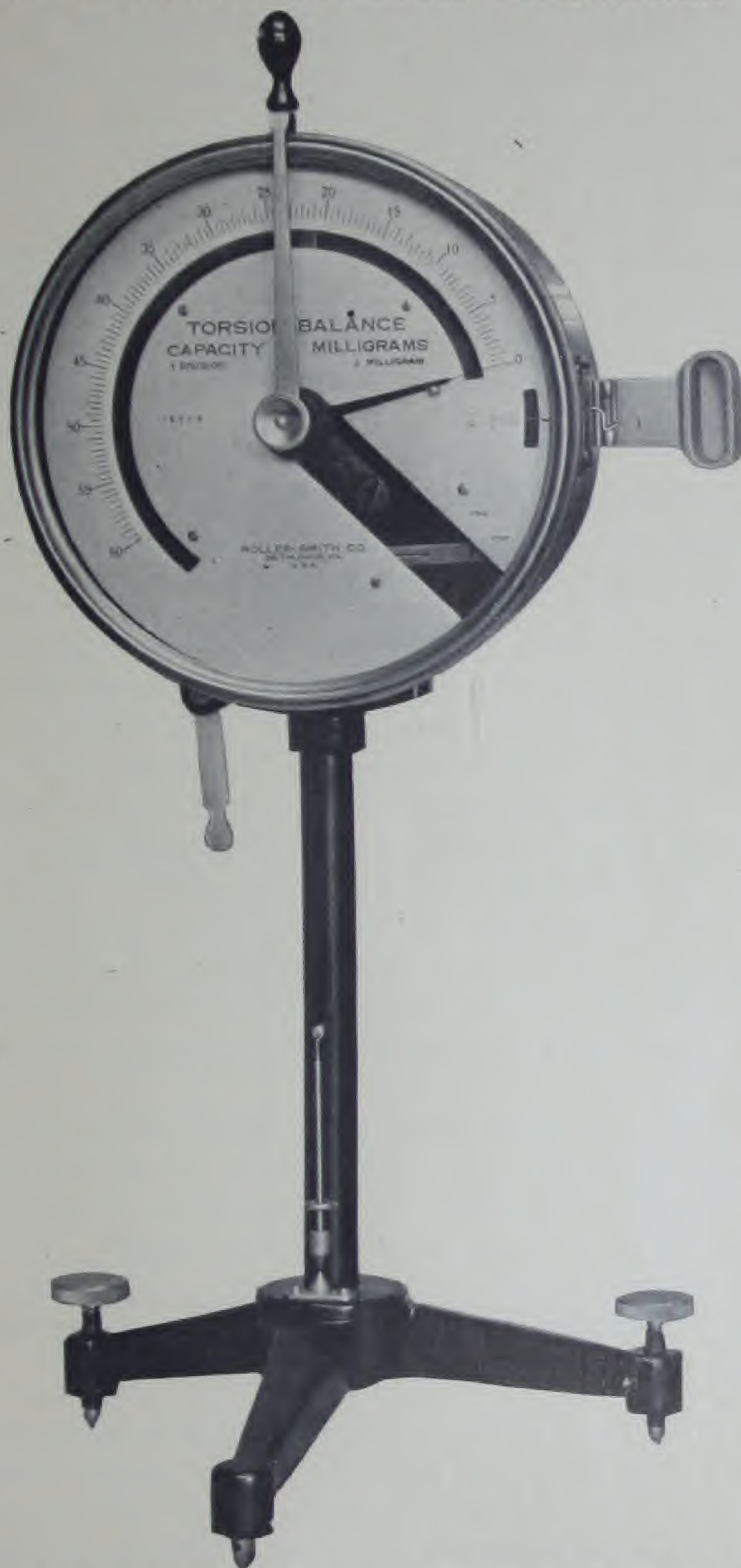
There are no loose parts. Nothing in the instrument can become demagnetized and with ordinary care the instrument should last indefinitely.

Cat. No.	Description	List Price
2170s	Type BME Tester for No. 6 Dry Cells.....	\$4.00

Directions for ordering: Specify quantity and catalog number.
"s" indicates stock item.

BULLETIN No. 240
April, 1929
(Superseding issue of October, 1927.)

ROLLER-SMITH Precision Torsion Balances



ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

*Offices in Principal Cities in United States and Canada
Representatives in Australia, Cuba, Japan and Philippine Islands*

CIRCUIT
BREAKERS

RELAYS

ROLLER-SMITH

Precision Torsion Balances

GENERAL: This highly developed form of torsion balance designed especially for weighing lamp filaments, but may be used for weighing small masses of other material as well. Illustration of the complete instrument is shown on the front cover and a detailed view of the dial is shown on the rear cover.

ROLLER-SMITH torsion balances are used in large numbers in this country and abroad. They soon pay for themselves by the time saved in weighing. One of their chief characteristics is the rapidity with which weighings may be made—a highly important point in commercial work.

The instruments are simple and compact and will retain their accuracy under the most severe and continuous operating conditions provided they are used with reasonable care.

DESCRIPTION. The *scales* are about 10" long and are evenly divided. A *zero adjuster* is provided at the back of the instrument. *Finish* is black with nickel trimmings. *Damping* is obtained by means of an aluminum vane swinging between the poles of a permanent magnet. By means of a thumb nut the *handle* is adjustable on its axis to suit the convenience of the operator. The device is equipped with a *plumb-bob* and *leveling screws* and the projecting hook on which the filaments to be weighed are hung is protected from damage, when not in use, by swinging over it the hinged cover shown in the illustration. A *locking device* is provided so that the moving element may be clamped during transportation.

Knife-edge pointers are used and there is a *mirror* under each scale to avoid parallax errors. The *scale* is white with easily read black figures. The instruments are *accurate* to one-fifth of one per cent of full scale value at any point on the scale. Check weights are accurate within one-fifth of one per cent. *Average net weight* 7½ lbs.; *shipping weight*, 50 lbs. *Size* is 20 inches high by 9 inches wide by 8 inches deep.

MODE OF OPERATION. The balance is first leveled by means of the plumb-bob and leveling screws. The small cover on the hook is swung back and the object to be weighed is placed on the hook. The moving element is released by means of the lever at the bottom of the case, the lock indicator then showing "free." The small pointer at the right of the center of the case will then sink below the zero point, which is in the center of its short scale. The manually operated pointer is then rotated to the left, using the large adjustable handle, until the small pointer reads "zero." By noting the position of the large pointer the weight of the object is then read directly in milligrams from the scale.

PRICE LISTS

Torsion Balances

Cat. No.	Range	No. of Divisions	Value per Division	Width per Division	NET Price
100s	O— 6 Mg.	120	.05 Mg.	2.0 Mm.	\$108.00
102s	O— 12 "	120	.1 "	2.0 "	103.00
104s	O— 30 "	150	.2 "	1.6 "	97.00
106s	O— 60 "	120	.5 "	2.0 "	97.00
108s	O— 100 "	200	.5 "	1.2 "	97.00
110s	O— 200 "	200	1.0 "	1.2 "	97.00
112s	O— 500 "	250	2.0 "	1.0 "	97.00
114s	O—1000 "	200	5.0 "	1.2 "	97.00
116s	O—2000 "	200	10.0 "	1.2 "	100.00
115	O—12 Grams	120	.1 Gram	2.0 "	152.75
117s	O—25 "	250	.1 "	2.0 "	152.75
118	O—50 "	250	.2 "	2.0 "	152.75

* Price includes as standard equipment an aluminum scale pan $4\frac{1}{2}$ " x $2\frac{1}{2}$ " x 1" in the shape of a scoop, which form makes it convenient to weigh articles in packages or in quantities. Each scale pan carries the same serial number as the balance with which it is calibrated and scale pans are not interchangeable. The pans are detachable and are of such form as is most convenient for the purpose for which these pans are used.

"s" Indicates stock item.

Sets of Check Weights for

ROLLER-SMITH Torsion Balances

Cat. No.	For Use With Torsion Balances of Following Ranges	*Value of Each Weight	NET Price Per Set of Four
2420	O— 6 Milligrams	1, 2, 4, 6	\$10.00
2422	O— 12 "	1, 2, 4, 6	10.00
2424	O— 30 "	5, 10, 20, 30	10.00
2426	O— 60 "	10, 20, 40, 60	10.00
2428	O— 100 "	10, 20, 40, 60	10.00
2430	O— 200 "	20, 40, 80, 160	10.00
2432	O— 500 "	100, 200, 400, 500	10.00
2434	O—1000 "	100, 200, 400, 500	10.00
2436	O—2000 "	200, 400, 800, 1000	10.00
2423	O— 12 Grams	1, 2, 4, 6	11.00
2419	O— 25 "	2.5, 5, 10, 20	11.00
2421	O— 50 "	5, 10, 20, 30	11.00

* Values are in milligrams except for Catalog Numbers 2423, 2419 and 2421, which are in grams.

Check weights are sold in sets of four with the values so selected that by suitable combinations all of the major points on the scale can be checked. On smaller sizes, i.e., up to and including the 2000 m.g. scale, each check weight is furnished in a separate containing bottle and the four bottles are enclosed in a finished hard wood case. The weights are provided with a hole, or an eye, through which they may be hung on the weighing hook of the instrument. Check weights for the 12, 25, and 50 gram balances are in the form of small cylindrical weights suitable for placing in the weighing pan of the instrument. They are furnished in sets of four, each set enclosed in hard wood case.

IN ORDERING specify quantity and catalog number.

CIRCUIT
BREAKERS

RELAYS



Dial of ROLLER-SMITH Precision Torsion Balance

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pennsylvania, for that purpose.

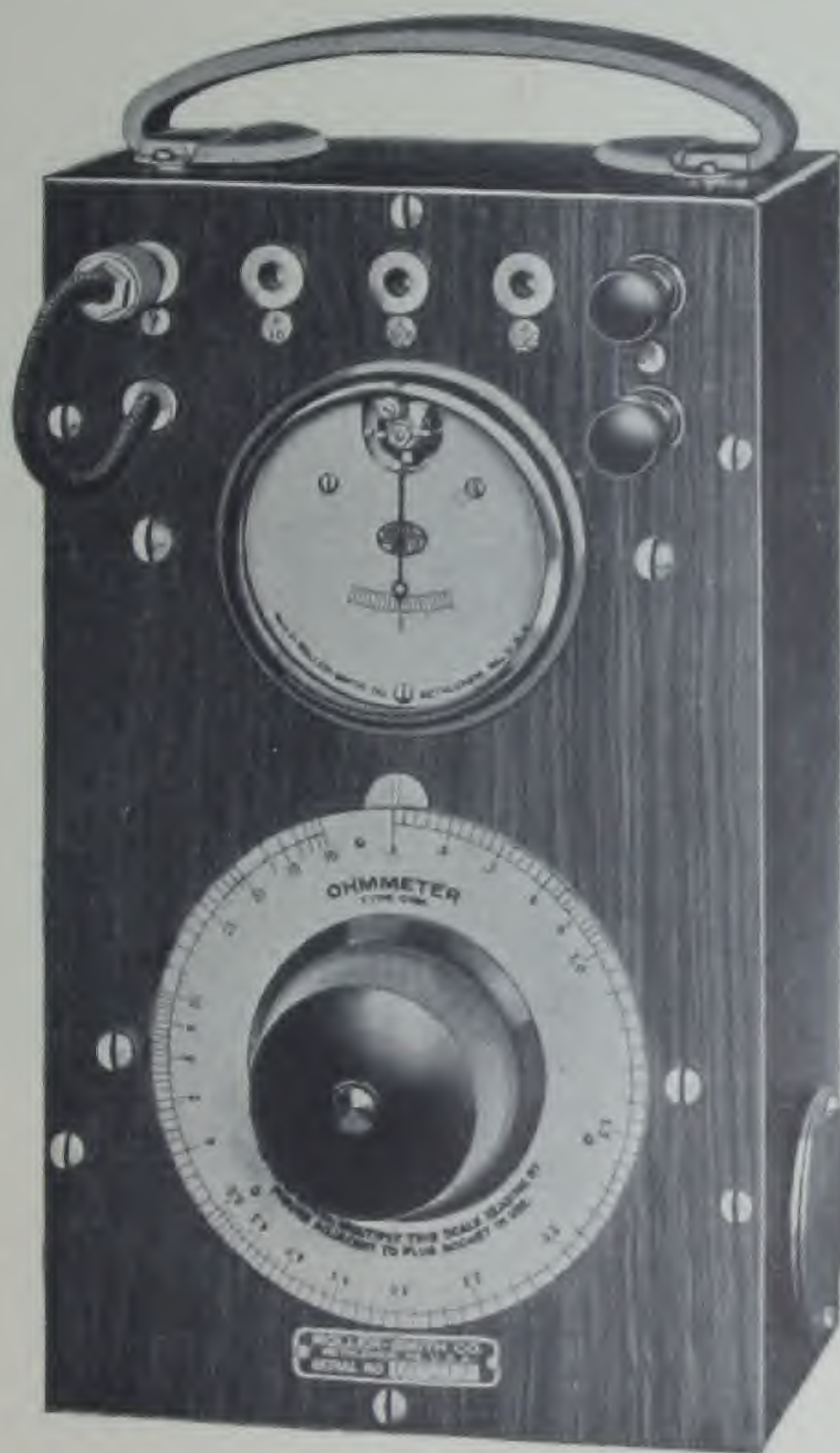
ROLLER-SMITH Products comprise complete lines of electrical protective and measuring apparatus. Bulletins covering the various devices will be sent on request.



BULLETIN No. 300
 November, 1929
 (Superseding issue dated
 June, 1928, and
 Supplement No. 1
 dated April, 1929)



**Portable, Direct Reading, Slide Wire
 OHMMETERS
 Types COM, GOM and SOM**
 —
Type HTD Circuit Testers



Type COM Ohmmeter

ROLLER-SMITH COMPANY
 Electrical Measuring and Protective Apparatus

MAIN OFFICE:
 233 Broadway, NEW YORK



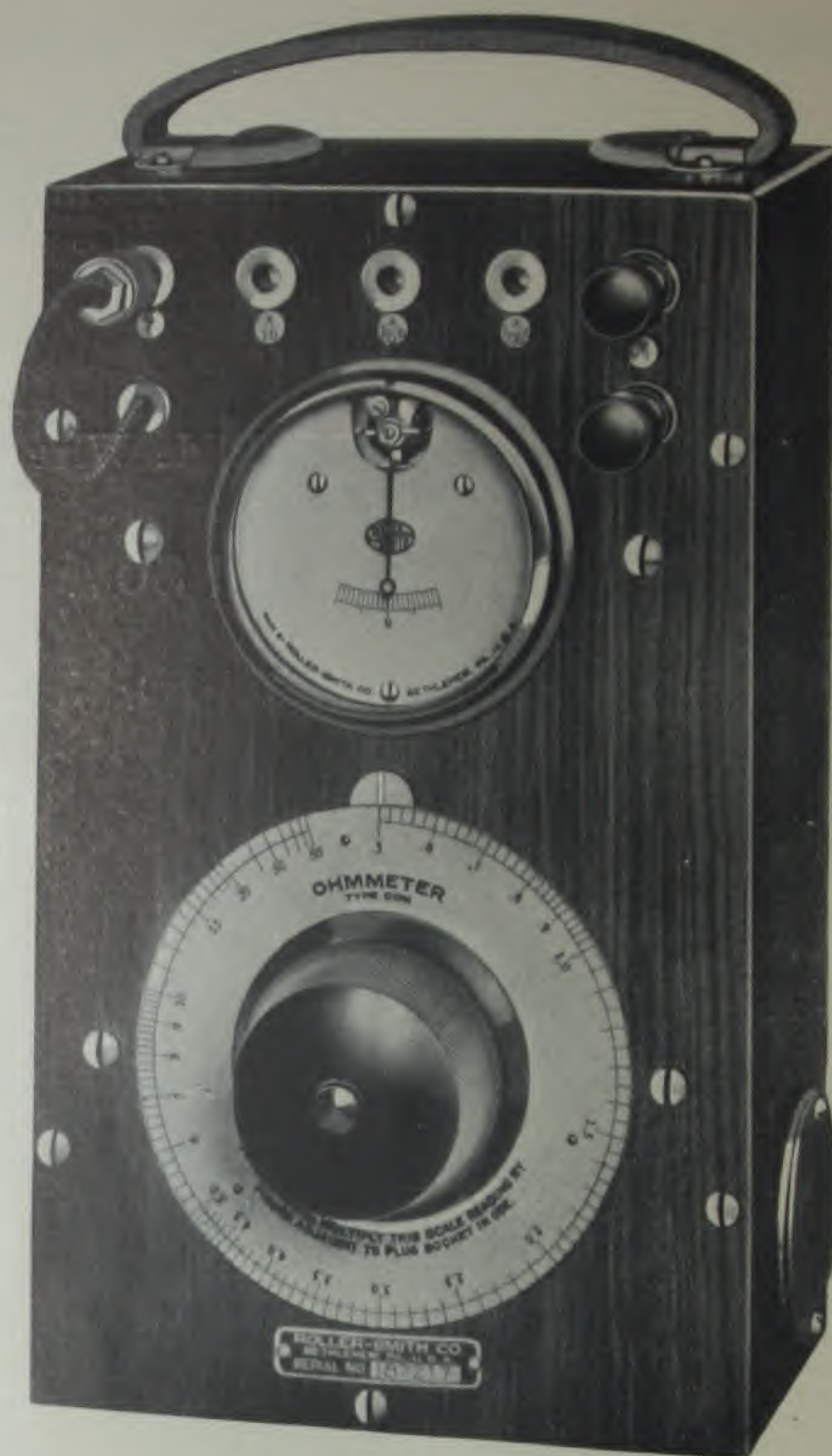
WORKS:
 Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

*Representatives in
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CIRCUIT
 BREAKERS

RELAYS



Type COM Ohmmeter

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Portable, Direct Reading Type COM OHMMETER

(See illustration on page 2)

USES

This instrument is a form of slide wire ohmmeter designed with particular reference to speed and simplicity in operation and low initial cost. Its design is such as to make it an ideal instrument for the rapid measurement of coils and resistance units on a quantity production basis. The instrument is entirely self-contained—there are no loose parts that may become lost.

GENERAL DESCRIPTION

The instrument case is of black walnut. The overall dimensions are 5 3/4" wide, 9 3/4" long and 4 1/4" high. The net weight is 3 1/2 lbs. A stitched leather handle is attached to the upper end and heavy rubber feet are provided on bottom of instrument. There are four ranges as follows:

Range Ohms	Value per Div.	Range in Ohms	Value per Div.
.5-1	.02 Ohm	50- 100	2.0 Ohms
1-2	.05	100- 200	5.0
2-5	.1	200- 500	10.0
5-10	.2	500- 1000	20.0
10-20	1.0	1000- 2000	100.0
20-50	5.0 Ohms	2000- 5000	500.0
5-10	.2 Ohm	500- 1000	20.0
10-20	.5	1000- 2000	50.0
20-50	1.0	2000- 5000	100.0
50-100	2.0 Ohms	5000-10000	200.0
100-200	10.0	10000-20000	1000.0
200-500	50.0	20000-50000	5000.0

OPERATION

To measure the ohmic resistance of a circuit attach the free ends of the two wires that form the terminals of the unknown resistance to the two "X" binding posts on the ohmmeter. These binding posts have hard rubber, non-removable tops. Insert the plug attached to the flexible cord near the top of the instrument into any one of the four sockets marked 1, 10, 100, 1000. Rotate the bakelite knob which is attached to the dial and, at the same time, depress the center button. If a balance on the galvanometer cannot be obtained with one complete revolution of the dial the plug should be shifted to the next socket and a revolution of the dial made again if necessary. When the galvanometer needle balances at zero the value of the resistance under measurement can be read on the dial at the point opposite the register mark. The numerals on the dial read directly when the dial plug is in the socket marked "1." When the plug is in sockets of higher value multiply the scale reading by the value of

the socket used. Note that it is impossible to obtain a galvanometer balance with resistances lower than .5 ohm and in excess of 50,000 ohms, these figures being the minimum and maximum limits of the instrument's range. The combination of dial, operating knob and battery key in one member permits of the operation of the instrument with one hand, leaving the other hand free.

BATTERY

The battery for this ohmmeter is self-contained, and consists of two standard cylindrical flash light cells each 1 1/4" diameter and 2 3/8" long which can be bought **anywhere**. The cells are slipped into a receptacle, access to which will be found on the right side of the case. To change cells swing the circular polished nickel plate free of the opening in the case and the old cells may readily be removed and new cells installed, without the aid of tools. Cells should be placed in instrument with center contact of inner cell at bottom of cell chamber. To ascertain whether the cells are sufficiently strong to give satisfactory indications on the galvanometer short circuit the "X" binding posts with a conductor of low resistance, put the plug in the No. 1 socket and rotate the dial so that the ".5" figure on the dial comes opposite the register mark. When the battery button is depressed, with the instrument arranged as above, the galvanometer pointer should deflect well beyond the end of the scale. If the cells are in need of replacement full scale deflection of the galvanometer pointer will not be obtained.

QUICK CONNECTION ADAPTER

In connection with the measurement of coils of fine wire, the operation of connecting the coil to the ohmmeter will be greatly speeded up by the use of an adapter, which is listed below. This adapter has spring jaws, which can be operated by two fingers of the person using the instrument. Much time may be saved by this method in preference to the placing of fine wires underneath the conventional binding post nuts. Two fine wires can be connected or disconnected in a fraction of a second by the use of an adapter. The use of this adapter has proved of very great value in the quantity production of coils.

ACCURACY

Resistances may be read to within an accuracy of approximately 1% of their value from the ".5" mark to and including the "10" mark, at which latter point the operator should shift to the next higher ratio to get best results. Above the "10" mark the corresponding accuracy is 2%.

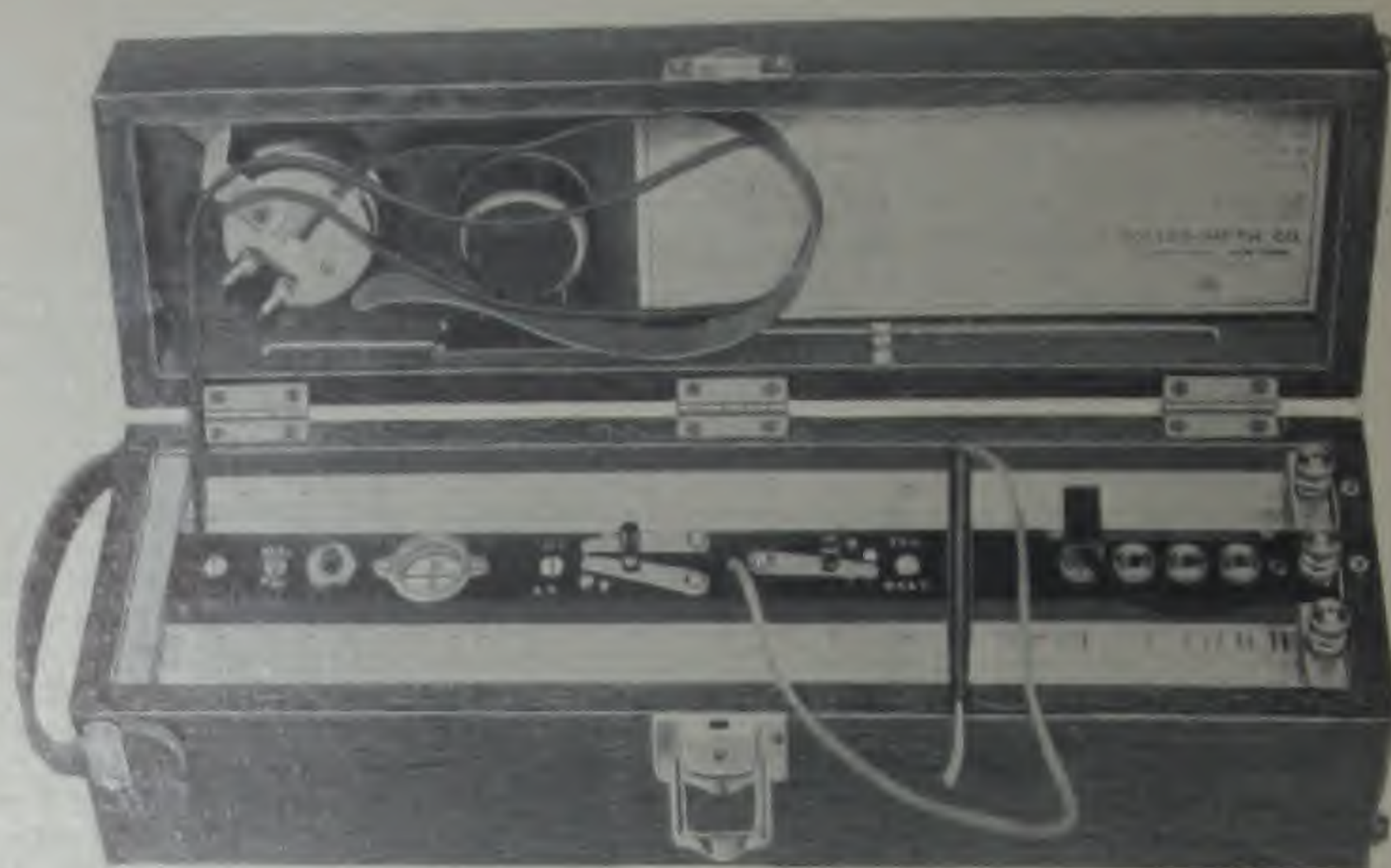
Cat. No.	LISTING	List Price
3007S	Type Com Ohmmeter, four ranges, .5-50, 5-500, 50-5000, 500-50000 ohms	\$70.00
3008S	Adapter (to be attached to "X" posts) for handling very small wires	2.50
3010S	Leads for use with Type COM Ohmmeter.....	2.85

"S" indicates stock item.

Leather carrying cases can be supplied. Prices on application.

DIRECTIONS FOR ORDERING Specify quantity and catalog number.

Portable Direct Reading Slide Wire Ohmmeter Type GOM



Type GOM Ohmmeter
Net Weight 11 lbs., size 17 x 5 x 5 inches. Shipping weight 22 lbs.

These Type GOM Ohmmeters have been on the market for several years, and their widespread use attests their popularity. In many respects they are superior to the Wheatstone bridge, having no loose plugs to be lost, being extremely simple to operate, and giving results which are read off directly in ohms from a scale without the necessity of any computation whatsoever.

The scales are 30 inches long and, therefore, can be read very closely. With each instrument there is supplied a pair of loose scales, equally divided, which may be dropped into place over the regular scales when locating crosses and grounds on lines, and which show directly the distance of the point of trouble from one or the other of the binding posts of the instrument. The two standard flash-light batteries necessary for the operation of the ohmmeter are self-contained and may be readily removed and replaced. All instruments are multi-scale, the numerals for the different scales being printed in different colors, so as to avoid any chance of confusion. Directions for taking resistance measurements are described in detail on a card located inside the cover of the case. In a separate direction book, supplied with each ohmmeter, there are directions for making other tests such as the location of crosses and grounds on a line. In the same direction book are diagrams, connections, wire tables, and other useful data.

The Type GOM is shown on this page. In addition to a telephone receiver with a head-band, it contains a d'Arsonval galvanometer of high sensibility together with an induction coil and sundry switches. By means of one switch located on the hard-rubber bar either the telephone receiver or the galvanometer may be used at will for

detection of attainment of balance, and, by means of another switch, the battery circuit is either applied direct or else used to excite the induction coil, from the secondary windings of which is then obtained alternating current. The galvanometer is valuable in that it enables the use of the instrument in locations where there is too much noise to permit of the employment of the telephone receiver, and is, incidentally, more sensitive to direct current than the latter. The induction coil is convenient, as alternating current is obtainable from its secondary windings, under which circumstances it converts the ohmmeter into a Kohlrausch bridge, which may be used for measuring the resistance of electrolytes and for the comparison of inductances and capacities.

By using the combination of direct current and telephone receiver, the instrument is capable of making a wide range of tests. The combination of direct current and galvanometer enables exactly the same tests but is independent of noise and more sensitive; it further allows making tests involving working to a false zero; the combination of alternating current and telephone receiver enables the location of breaks under ordinary circumstances, the comparison of inductances and capacities, the measurement of resistance of electrolytes and the measurement of the internal resistance of batteries; it allows also testing for the location of faults, even if a disturbing E. M. F. exists at the faults.

The case is highly finished hardwood with polished nickel trimmings and is provided with a hinged top, latch and lock and with leather carrying handle. Rubber feet are provided at the bottom and at one end. The apparatus is self-contained and complete in all particulars.

Cat. No.	Ranges	List Price
3002S	0 to 10, 100, 1,000 and 200,000 ohms respectively. (Four scales)	\$150.00
3003S	0 to 10, 100, 1,000 and 2,000,000 ohms respectively. (Four scales)	\$170.00

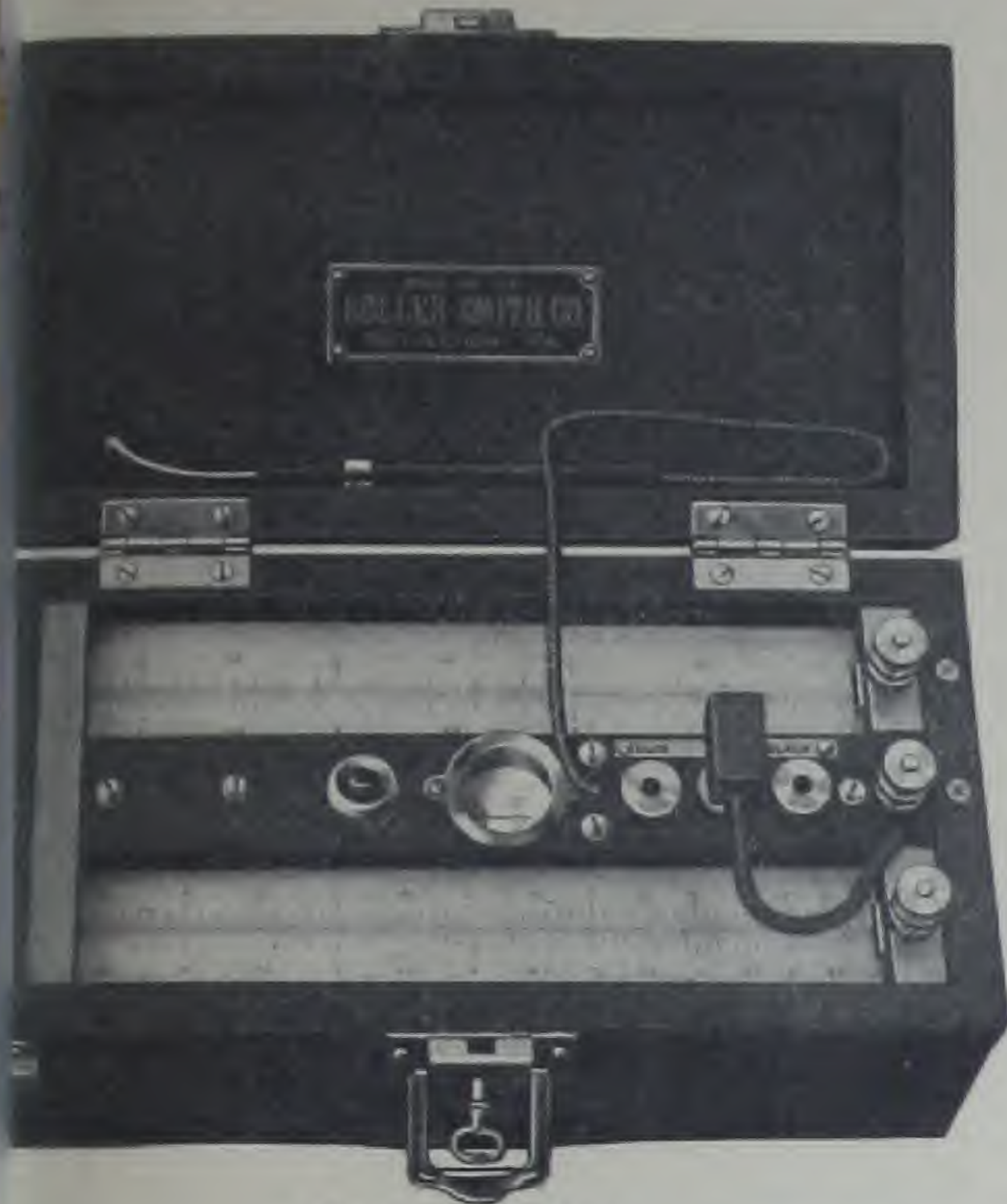
"S" indicates stock item.

Leather carrying cases can be furnished. Prices on application.

Directions for Ordering: Specify quantity and catalog number.

Portable Direct Reading Slide Wire Ohmmeters

Type SOM



Cat. No. 1006

Dimensions, 9½ x 5 x 5 inches; weight 5 lbs.

This instrument, while originally designed for use in signal system testing, is useful for general testing work where a high range in ohms is not needed. It is smaller in size and lighter in weight than the Type GOM, which is frequently of advantage when transportation by hand is involved.

The Type SOM Ohmmeter is a modified form of our Type GOM ohmmeter, which has been on the market many years and large numbers of

which are giving good service under all kinds of conditions. It is, in general, a slide wire bridge having self-contained *galvanometer* of sensitive but rugged design, self-contained *dry cells* which are conveniently located for renewal, *galvanometer key*, *stylus* and self-contained *resistances*—in fact the instrument is complete in itself.

The case is of hard wood and provided with hinged top, latch and lock and leather handle.

There are *three ranges*, namely, 0-1, 0-10 and 0-100 (or 0-1000) ohms, each on a *scale 15 inches long*, each scale being a different color, namely: blue, red and black. Means are thus provided for making all relay point tests, as well as many other resistance measurements within the range of the device.

An unknown resistance is measured by connecting it to points XX. The plug is inserted in one of the sockets marked "blue, red, black," and the stylus tapped along the wire that runs from end to end of the scale. At a certain point there will be no deflection of the galvanometer pointer. The resistance is then read off the scale, using figures of color corresponding to the socket. If the first test indicates that a closer reading could be obtained with another range, it is only necessary to change the plug to another socket and find point of no deflection as before.

PRICE LIST

Cat. No.	Ranges	Value Per Scale Division	List Price
1006 S	0-1 OHM	0-.1 ohm in .001 ohm divisions	\$122.00
		.1-.6 " " .002 " "	
		.6-1 " " .005 " "	
	0-10 OHMS	0-1 ohm in .01 ohm divisions	
		1-6 ohms " .02 " "	
		6-10 " " .05 " "	
	0-100 OHMS	0-1 ohms in .1 ohm divisions	
		1-6 " " .2 " "	
		6-10 " " .5 " "	
1030 S	0-1 OHM	0-.1 ohm in .001 ohm divisions	\$122.00
		.1-.6 " " .002 " "	
		.6-1 " " .005 " "	
	0-10 OHMS	0-1 ohm in .01 ohm divisions	
		1-6 ohms " .02 " "	
		6-10 " " .05 " "	
	0-1000 OHMS	0-100 ohms in 1. ohm divisions	
		100-600 " " 2. " "	
		600-1000 " " 5. " "	

"S" indicates stock item.
Leather carrying cases can be supplied. Prices on application.
Directions for Ordering: Specify quantity and catalog number.

CIRCUIT
BREAKERS

RELAYS

Portable, Direct Reading Type HTD Circuit Tester



Cat. No. 3009 Type HTD Circuit Tester

USES

The uses of the HTD Circuit Tester are two-fold. The instrument can be used to ascertain if there is an electrical circuit existing between conductors applied to the terminals of the instrument and, secondly, it enables the user to read the resistance of the circuit under test. The HTD Circuit Tester is recommended for use in preference to magnetos and A.C. bell-ringing devices because of its accuracy of indications under all conditions and its lightness and compactness as well. The instrument measures $4\frac{1}{2}'' \times 3'' \times 1\frac{1}{2}''$, which dimensions are obviously much less than those of the conventional magneto outfit. Likewise, its light weight of 19 ounces commends it when compared with the bulkier and heavier magnetos. Indications on the HTD Circuit Tester are never misleading, whereas, the alternating current generated by the hand-driven magnetos will often cause the bell to ring when circuits include condensers, even though the circuit itself is not complete. Likewise with magnetos testing the accumulative leakages in wiring encased in metal conduit will indicate that the circuit is complete because of the condenser action, while actually the circuit is

open. With the HTD Circuit Tester inductance or capacity in the circuit under test have no effect on the readings. The instrument is recommended particularly for use by wiremen, repairmen, and on coil and other electrical work which necessitates identification and checking up of various circuits. It may be carried in the pocket and conveniently be used when working ladders or in places difficult of access.

GENERAL DESCRIPTION

This instrument consists of a small high grade d'Arsonval type D.C. voltmeter (our TD mechanism) connected in series with a small dry cell. The circuit is such that when the terminals of the instrument are connected the circuit is completed. The instrument pointer will indicate full scale when the terminals are short-circuited.

SCALE

The scale reads directly in ohms which enables resistance readings of the circuit under test.

CASE

The instrument is enclosed in a heavy sheet metal case with black finish and is equipped with nickel-plated binding posts. An etched metal instruction plate is attached to the front of the instrument, giving instructions regarding replacement of the battery and the checking of the calibration. By the removal of three screws the instruction plate can be taken off and the dry cell rendered accessible for replacement. The removal of this plate also gives access to the internal zero adjuster.

BATTERY

A standard flash light battery, 1" diameter by $1\frac{3}{8}''$ long, is employed for the Cat. Nos. 3009 and 3011. The Cat. No. 3013 takes a 3 volt "vest pocket" type flash light battery. These cells can be bought everywhere. Because of the low current consumption of the instrument the battery should give service for many months. From time to time the condition of the battery can be determined by short-circuiting the terminal posts, which should give full scale deflection of the pointer. An adjusting screw is provided whereby falling off in battery voltage can be compensated for up to the point of practical exhaustion of the cell.

(See page 7 for listing)

LEADS

The Cat. No. 3010 leads are for universal testing. They are about 50" long. One lead has a spade terminal on one end and a Mueller clip on the other end. The second lead has a spade terminal on one end and a 3½" prod on the other end.

The Cat. No. 3012 leads are for continuity testing of radio receiving sets. They are about 50" long. Both leads have a spade terminal at one end and a 5¼" insulated prod on the other end.

Cat. No.	Listing	List Price
09S	Type HTD Circuit Tester, 10,000 ohms.....	\$21.00
11S	Type HTD Circuit Tester, 100,000 ohms.....	25.00
13S	Type HTD Circuit Tester, 200,000 ohms.....	26.00
10S	Leads for universal testing; for use with Cat. No. 3009 Type HTD Circuit Tester.....	2.85
12S	Leads for testing continuity of radio receiving sets; for use with Cat. Nos. 3011 and 3013 Type HTD Circuit Testers.....	2.85
206S	Leather carrying case; for use with Cat. Nos. 3009, 3011 or 3013 Type HTD Circuit Testers.....	3.25

"S" Indicates stock item.

Directions for Ordering:—Specify quantity and catalog number.

ROLLER-SMITH PRODUCTS

ROLLER-SMITH products comprise complete lines of electrical measuring instruments, relays and circuit breakers. Bulletins covering the various devices will be sent promptly on request.

SWITCHBOARD INSTRUMENTS

C. Ammeters, Voltmeters and Volt-ammeters, 3½" and 4" sizes	Bulletin No. 400
C. Ammeters, Voltmeters and Wattmeters, 3½" and 4" sizes	" " 420
C. Ammeters and Voltmeters, large sizes.....	" " 430
C. Ammeters, Voltmeters, Wattmeters, Power Factor Meters, Frequency Meters, large sizes; Triplex Ammeters	" " 450
Radio Frequency Ammeters, all sizes.....	" " 810

PORTABLE INSTRUMENTS

C. and D. C. Ammeters, Voltmeters and Volt-ammeters; Ohmmeters and Circuit Testers for signal system and train control apparatus testing.....	Bulletin No. 100
C. Ammeters, Voltmeters and Volt-ammeters, small size	" " 110
C. Ammeters, Voltmeters, Volt-Ammeters, Wattmeters, Frequency Meters and Power Factor Meters, large and small sizes	" " 160
Oil Bond Testers.....	" " 200
C. Ammeters, Voltmeters, Volt-Ammeters and Galvanometers, large sizes	" " 210
Precision Torsion Balances for weighing lamp filaments and other small bodies	" " 240
Ohmmeters and Circuit Testers.....	" " 300

INSTRUMENT TRANSFORMERS

Portable types	Bulletin No. 160
Switchboard types	" " 450

AIR CIRCUIT BREAKERS

C. and D. C., Industrial Type, all styles of trips, 100 amperes and less	Bulletin No. 520
C. and D. C., Standard Type, all styles of trips, all ampere capacities	" " 530
C. and D. C., Enclosed Type, 800 amperes and less.....	" " 580

OIL CIRCUIT BREAKERS

100 to 2,000 Amps., 2,500 to 15,000 Volts.....	Bulletin No. 600
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RELAYS

D. C. Relays, reverse current, etc.....	Bulletin No. 550
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ROLLER-SMITH Products comprise complete lines of Electrical Instruments, indicating and graphic, Relays and air and oil Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

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NEW YORK	233 Broadway		

A B R O A D

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ASHIDA ENGINEERING CO.	Daini, Osaka, Japan
MANILA MACHINERY & SUPPLY CO., INC.,	Box 607, Manila, Philippine Islands





Type HTD RADIO CONTINUITY TESTER

On the reverse side of this sheet is a test table covering the use of the Type HTD Radio Continuity Tester with Atwater-Kent Models 40, 42 and 52 radio receiving sets. The figures in the column headed "Correct Reading" refer to the scale reading on the Continuity Tester.



Full details of the Continuity Tester are given in Supplement No. 1 to Bulletin No. 300, a copy of which will be furnished on request.

ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada
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CIRCUIT
BREAKERS

RELAYS

Continuity Test Table—Models 40, 42 and 52

Colors Refer to Cable Leads

For Following Tests Remove Cable Panel from Power Unit

TEST FROM	Correct Reading	WRONG READING INDICATES	REMARKS and FURTHER POSSIBILITIES
Red-Green Tr. to +F2A Black-Green Tr. to -F2A Red-White Tr. to +FD Black-White Tr. to -FD Red to +F1A Black to -F1A Green-Yellow Tr. to Speaker Post No. 2 Green to Ground Post. Brown to P2A. White to 4 (on R.F. Plate Resistance).	50	Open in cable or connection.	Examine soldered connections cable connection panel and
GREEN to P1A PD P3R +F3R, -F3R +FD, -FD +F2A, -F2A G2R, G3R	0 0 0 0 0 0 39.5-40.5	Grounded 1st A.F. plate circuit. Grounded detector plate circuit. Grounded R.F. plate circuit. Grounded R.F.-1st A.F. filament circuit. Grounded detector filament circuit. Grounded 2nd A.F. filament circuit. None—Open grid resistor or secondary No. 1, 2 R.F.T. Full—Shorted grid circuit.	Or shorted phone condenser. Or shorted R.F. by-pass condense Or shorted R.F. by-pass condense
G1R G1A G2A Stator of Detector Variable Condenser CD	49 Close 7.5 Close 13.5 Close 50 50	Open antenna coupling transformer. None—Open secondary No. 1 A.F.T. None—Open secondary No. 2 A.F.T. Open secondary last R.F.T. Open cathode lead.	Volume control full right. Full—Shorted secondary. Full—Shorted secondary.
WHITE to 3 (on R.F. Plate Res.)	15 Close	None—Open R.F. plate circuit resistance	Full—Shorted R.F. plate circuit r
P1R, P2R, P3R.	15 Close	Open primary No. 1, 2, 3 R.F.T.	
YELLOW to PD	27-30	None—Open primary No. 1 A.F.T. (or open in cable connection).	Full—Shorted primary.
Black-Red Tracer to P1A	20-23	None—Open primary No. 2 A.F.T. (or open in cable connection).	Full—Shorted primary.
OTHER TESTS GD to Stator of Last Condenser. P2A to Speaker Post No. 1. G1R to Ant. Terminal. To Test Volume Control, Unsolder Red Lead from Antenna Cou- pling Transformer and Test Across Antenna and Ground Terminals, Turning Control Knob.	0 0 49.5 exact 39 to 50	Shorted grid condenser. Shorted speaker filter condenser. Open antenna connection. No reading—open resistance winding. Erratic reading—damaged resistance winding or slider.	Mounted on back of det. var. cor If found defective, repair or inst new control. Resolder red lea



CIRCUIT
BREAKERS

RELAYS



BULLETIN No. 520

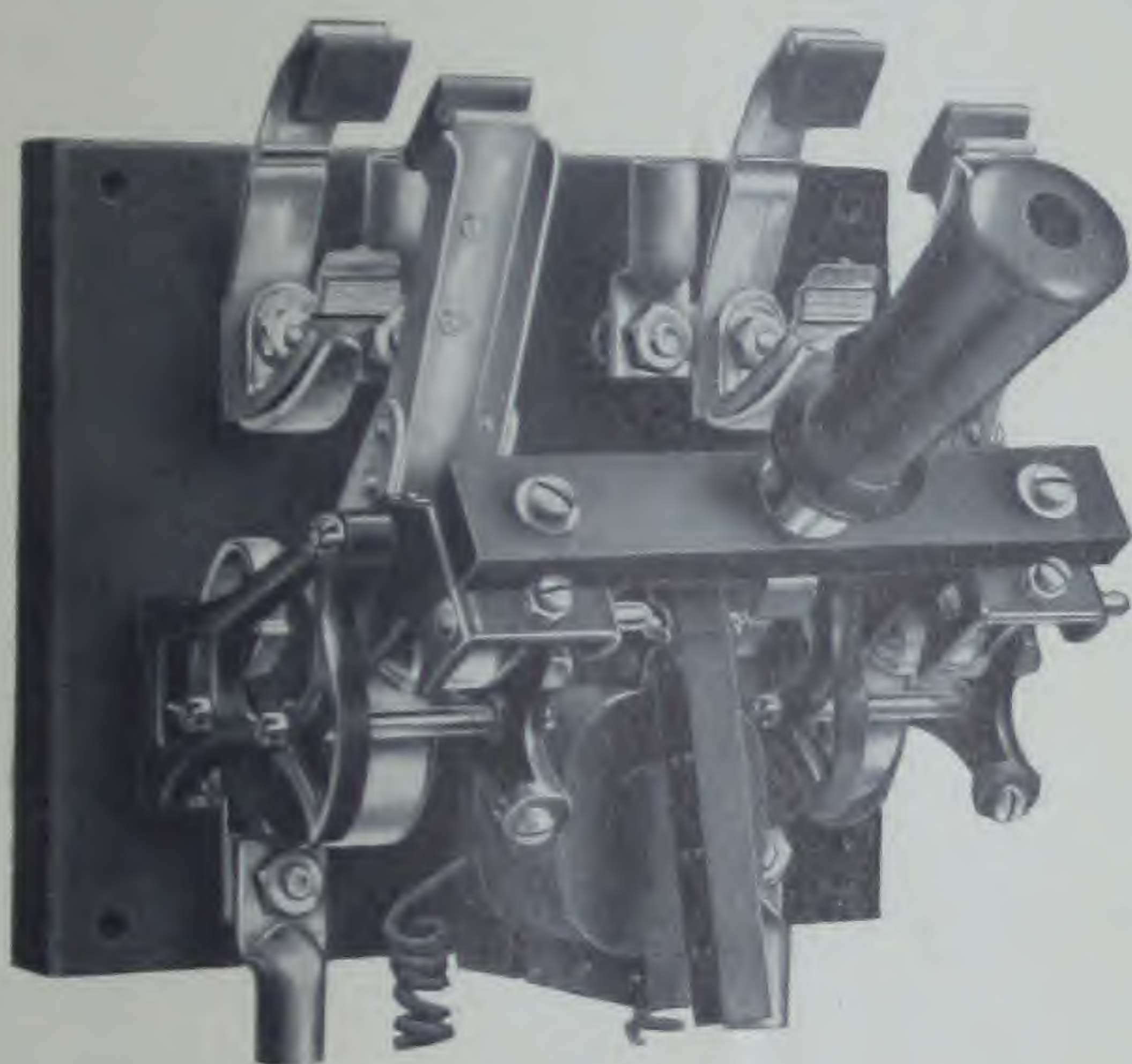
December, 1927

(Superseding issue
dated October, 1926.)



"INDUSTRIAL" TYPE Circuit Breakers

Overload, Underload, Under-Voltage



100 ampere, 220 volt, two pole, rigid arm, combined overload and under-voltage, "Industrial" Type Circuit Breaker

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

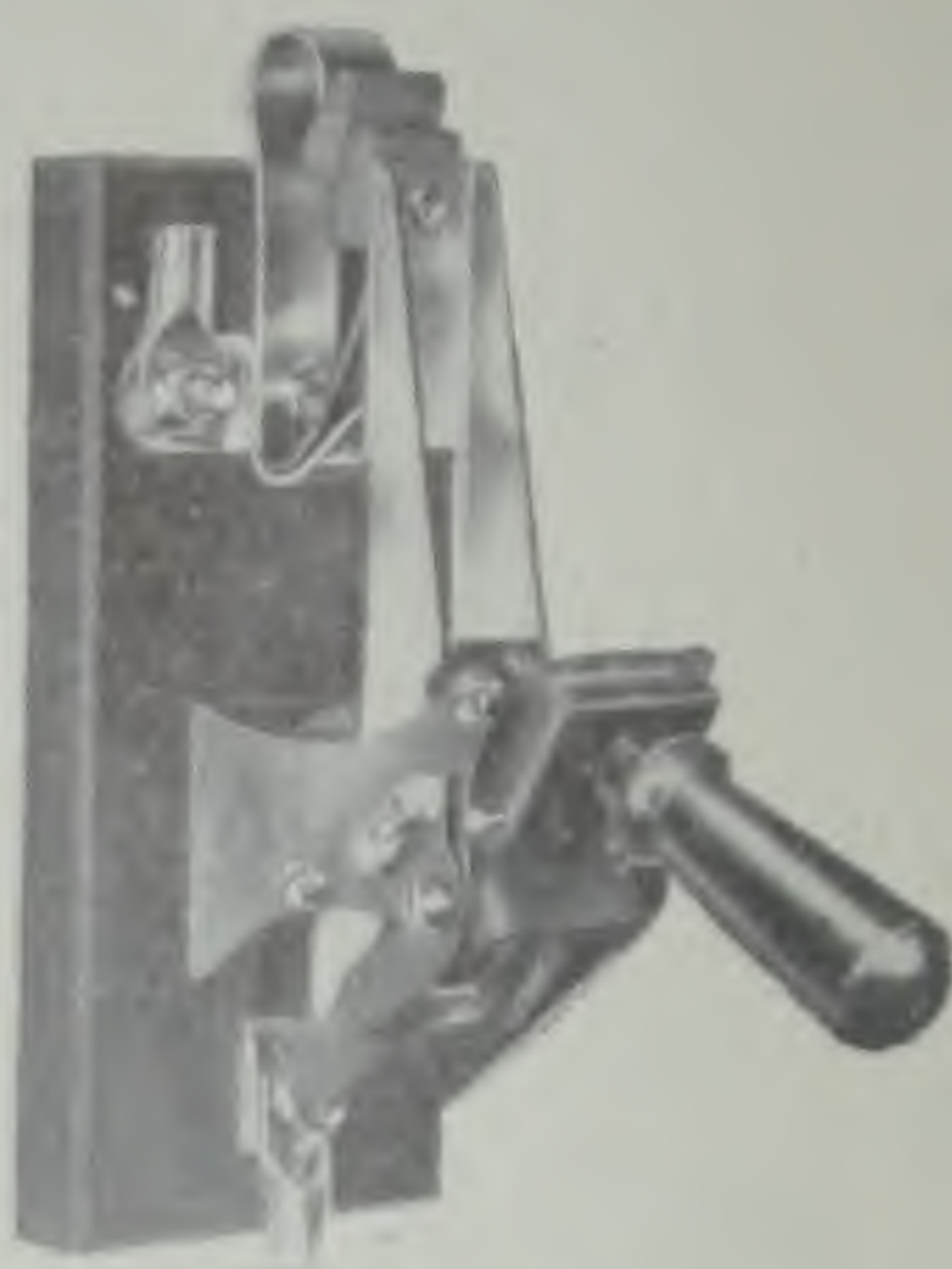
Offices in Principal Cities in United States and Canada,

*Representatives in
Australia, Cuba, Japan and Philippine Islands*

ROLLER-SMITH

"Industrial" Type Circuit Breakers

INTRODUCTORY



45 ampere, 250 volt, single pole, plain overload, "Industrial" Type circuit breaker.

The ROLLER-SMITH "Industrial" Type circuit breakers operate on exactly the same principle as the well-known "Standard" Type. They are, however, most generally used in industrial plants where the fine finish of the "Standard" Type is not necessary and, therefore, some of the refinements of detail characteristic of the "Standard" Type are omitted.

"Industrial" Type circuit breakers are of simple and rugged design, built for the hardest kind of year-in-and-year-out service. The thousands in daily use in the United States and abroad testify to the dependability. They are offered in a variety of combinations as listed in the following pages.

DESCRIPTION

FINISH: All current carrying parts are dipped and lacquered; all other parts black.

MOUNTING: For wall mounting breakers are furnished on finished slate bases with suitable cable lugs on front. For switchboard mounting (furnished only on special order at an extra charge) breakers are mounted on templates and have back connected studs, cable lugs being supplied for only one stud of each pole.

OVERLOAD CALIBRATION: Range of adjustment is from normal rating to twice normal rating. For instance a 100 ampere breaker can be set to trip as low as 100 amperes and as high as 200 amperes. In certain cases a greater range of adjustment is possible. Details on application. Calibration scale is in plain view and change of setting is easily made.

All parts are securely locked in place and will not work loose. Each pole has its own overload coil, "a coil to a pole." All bearing surfaces are non-rustable. Triggers, latches, cams, levers and other fussy and trouble breeding parts are conspicuous by their absence.

OPERATION: Pull down on handle to close, pull up to open.

Wiring diagrams are supplied with all under-voltage breakers. Data sheet "DE" (furnished on application) gives all dimensions.



100 ampere, 250 volt, single pole, plain overload, "Industrial" Type circuit breaker.

"INDUSTRIAL" TYPE CIRCUIT BREAKERS

PLAIN OVERLOAD

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT OR ALTERNATING CURRENT									
	Cat. No.	1 Pole	Cat. No.	2-Pole Ind'p't Arm	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
3	52000	\$19.00	52018	\$38.00	52036	\$38.00	52054	\$57.00	52072	\$76.00
5	52002	19.00	52020	38.00	52038	38.00	52056	57.00	52074	76.00
10	52004	19.00	52022	38.00	52040	38.00	52058	57.00	52076	76.00
15	52006	19.00	52024	38.00	52042	38.00	52060	57.00	52078	76.00
30	52008	19.00	52026	38.00	52044	38.00	52062	57.00	52080	76.00
45	52010	19.00	52028	38.00	52046	38.00	52064	57.00	52082	76.00
60	52012	19.00	52030	38.00	52048	38.00	52066	57.00	52084	76.00
80	52014	19.00	52032	38.00	52050	38.00	52068	57.00	52086	76.00
100	52016	22.50	52034	45.00	52052	45.00	52070	67.50	52088	90.00

For capacities over 100 amperes, and for potentials over 250 volts, see Bulletin No. 530.

MOUNTING: "Industrial" Type breakers are regularly furnished with front connections for wall mounting. They can be supplied with back connections for switchboard mounting on special order at an extra charge of 10%. If this style of mounting is desired add "switchboard mounting" after catalog number.

DIRECTIONS FOR ORDERING: Specify quantity, catalog number, voltage, whether A. C. or D. C., and, if A. C., the frequency and special details, if any. Entry of orders will always be delayed unless this information is given.

APPLICATION: Plain overload circuit breakers are used for the protection of motors, generators, light and power circuits and for other applications where protection is desired against overloads and short-circuits.

"INDUSTRIAL" TYPE CIRCUIT BREAKERS**UNDERLOAD**

†Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT CURRENT ONLY					
	Cat. No.	1-Pole Plain Underload	Cat. No.	2-Pole Rigid Arm 1-Pole Plain Overload 1-Pole Plain Underload	Cat. No.	2-Pole Ind'p't Arm 1-Pole Plain Overload 1-Pole Plain Underload
3	52180	\$28.50	52216	\$47.50	52198	\$47.50
5	52182	28.50	52218	47.50	52200	47.50
10	52184	28.50	52220	47.50	52202	47.50
15	52186	28.50	52222	47.50	52204	47.50
30	52188	28.50	52224	47.50	52206	47.50
45	52190	28.50	52226	47.50	52208	47.50
60	52191	28.50	52227	47.50	52009	47.50
80	52193	28.50	52229	47.50	52011	47.50

†For underload breakers in capacities over 80 amperes, see listing of Standard Type circuit breaker on page 14 of Bulletin No. 530.

MOUNTING: Standard mounting is on slate base with front connections, but switchboard mounting, i.e., mounted on template with back connections, can be supplied on special order at an extra charge of 10%. If this style of mounting is desired add "switchboard mounting" after catalog number.

TRIPPING POINTS: All underload circuit breakers are set to trip when the current falls to about 10% of rated ampere capacity. The underload feature is adjustable over a very wide range. For instance, a 10 ampere breaker set to trip at about 1 ampere, could be adjusted to trip at about the same point with the breaker operating at one-half rated capacity.

DIRECTIONS FOR ORDERING: Specify quantity, catalog number, voltage, and special details, if any. Entry of orders will always be delayed unless this information is given.

APPLICATION: Underload circuit breakers are used chiefly in battery charging work and their function is to disconnect the battery from the charging source if that source fails, also to disconnect the battery when current drops to a predetermined minimum through the approach of the full charge condition.

REVERSE CURRENT CIRCUIT BREAKERS: Reverse current circuit breakers are generally used on all large size battery charging outfits. For reverse current protection the proper equipment is a shunt-trip circuit breaker and a reverse current relay with shunt. For further details see Bulletin No. 530, covering "Standard" Type circuit breakers.

"INDUSTRIAL" TYPE CIRCUIT BREAKERS

PLAIN UNDER-VOLTAGE

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT OR ALTERNATING CURRENT									
	Cat. No.	1-Pole 1 U. V. Coil	Cat. No.	2-Pole Rigid Arm 1 U. V. Coil	Cat. No.	3-Pole Rigid Arm 1 U. V. Coil	Cat. No.	4-Pole Rigid Arm 2 U. V. Coils		
*80	52288	\$31.00	52292	\$38.00	52296	\$57.00	52300	\$88.00		
*100	52290	34.50	52294	45.00	52298	67.50	52302	102.00		

*For currents of 80 amperes and under use the 80 ampere size; for currents between 80 and 100 amperes use the 100 ampere size.

COMBINED OVERLOAD AND UNDER-VOLTAGE

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT OR ALTERNATING CURRENT									
	Cat. No.	1-Pole 1 U. V. Coil	Cat. No.	2-Pole Ind'p't Arm 1 U. V. Coil	Cat. No.	2-Pole Rigid Arm 1 U. V. Coil	Cat. No.	3-Pole Rigid Arm 1 U. V. Coil	Cat. No.	4-Pole Rigid Arm 2 U. V. Coils
3	52320	\$31.00	52338	\$50.00	52356	\$50.00	52374	\$69.00	52392	\$100.00
5	52322	31.00	52340	50.00	52358	50.00	52376	69.00	52394	100.00
10	52324	31.00	52342	50.00	52360	50.00	52378	69.00	52396	100.00
15	52326	31.00	52344	50.00	52362	50.00	52380	69.00	52398	100.00
30	52328	31.00	52346	50.00	52364	50.00	52382	69.00	52400	100.00
45	52330	31.00	52348	50.00	52366	50.00	52384	69.00	52402	100.00
60	52332	31.00	52350	50.00	52368	50.00	52386	69.00	52404	100.00
80	52334	31.00	52352	50.00	52370	50.00	52388	69.00	52406	100.00
100	52336	34.50	52354	57.00	52372	57.00	52390	79.50	52408	114.00

†For capacities over 100 amperes, and for potentials over 250 volts, see Bulletin No. 530.

MOUNTING: Standard mounting is on slate base with front connections but switchboard mounting, i.e., mounted on template with back connected studs, can be supplied on special orders at an extra charge of 10%. If switchboard mounting is wanted add "switchboard mounting" after catalog number.

TRIPPING POINTS: All under-voltage breakers are adjusted to trip when voltage falls to about 60% of normal for D. C. and to about 90% of normal for A. C.

DIRECTIONS FOR ORDERING: Specify quantity, catalog number, exact operating voltage, whether A. C. or D. C. and if A. C., number of phases, wires, and frequency and special details, if any. Entry of orders will always be delayed if this information is not given.

APPLICATION: The function of under-voltage breakers is indicated by the name, i.e., to open the circuit when the voltage falls to a low point or fails entirely. They are used also for remote control purposes when it is desired to open a circuit at some distant point by merely pushing a button. They are used also on cranes and on coal handling equipments for limiting the travel of the hoist. As a rule, for remote control purposes shunt-trip circuit breakers are to be preferred to breakers of the under-voltage type. For shunt-trip circuit breakers see Bulletin No. 530.

It is just as important to protect motor circuits against failure and subsequent resumption of voltage as it is to protect them against overloads.

"INDUSTRIAL" TYPE CIRCUIT BREAKERS

PLAIN SHUNT-TRIP

and

COMBINED OVERLOAD AND SHUNT-TRIP

Shunt-trip circuit breakers are not supplied in the "Industrial" Type but they can be supplied in the "Standard" Type. See Bulletin No. 530.

"SHOCK PROOF" CIRCUIT BREAKERS

"Standard" Type circuit breakers with the "Shock Proof" feature can be supplied. See Bulletin No. 530 for details.

"INTERLOCKED TRIP" CIRCUIT BREAKERS

"Standard" Type circuit breakers with the "Interlocked Trip" feature can be supplied with "Independent Arm" circuit breakers. See Bulletin No. 530 for details.

AUXILIARY SWITCHES

These are small switches which are actuated by the moving contact arm. They operate the auxiliary circuit and are made in two forms: One opens when the breaker opens and one closes when the breaker opens. They are frequently used to operate alarm bells, signal lamps and similar devices and are also used to open the under-voltage coil circuit when the under-voltage breaker is in its open position. The tripping coil of an under-voltage breaker cannot be left indefinitely in circuit without risk of burning out. On auxiliary switch, opening when the breaker opens, is recommended on such installations.

List prices are as follows:

(3 to 80 amperes)	\$10.00
(100 amperes)	11.00

"STANDARD" TYPE CIRCUIT BREAKERS

In our Bulletin No. 530 we list our complete line of "Standard" Type circuit breakers. These are more highly finished than the "Industrial" Type and are supplied in a wider variety of styles and capacities as follows:

5 to 12000 amperes; up to 600 volts; with shunt-trip; "Shock Proof" double pole, independent arm breakers with "Interlocked Trip"; non-closable on-overload (Free Handle), "Time Limit" features.

Bulletin No. 530 will be sent on request.

ENCLOSED CIRCUIT BREAKERS

We manufacture a complete line of enclosed circuit breakers. Bulletin No. 530 covering these breakers will be sent on request.

THE CIRCUIT BREAKER TO USE

NUMBER OF POLES

ON TWO WIRE CIRCUITS: A single pole plain overload breaker gives protection and will save the fuses, but a fused knife switch must then also be employed. A double pole circuit breaker gives full automatic protection and switches can then be dispensed with. The independent arm type is usually to be preferred as one pole can be closed at a time and, should an overload or short-circuit exist, the pole first closed will open immediately after the other pole is closed. A rigid arm breaker may, however, be used, if so desired, if a knife switch is used also.

ON THREE WIRE CIRCUITS: On any three wire, A. C. or D. C. circuit a rigid arm three pole breaker is generally used but a two pole rigid arm device may be used under certain conditions.

ON TWO PHASE FOUR WIRE CIRCUITS: A four pole rigid arm breaker is usually desirable, but frequently a two pole rigid arm breaker is satisfactory if so connected as to effectively open one wire of each phase.

STYLE OF TRIP

OVERLOAD: This is, of course, employed to protect apparatus against currents in excess of normal, particularly against short-circuits. It is used on practically all types of circuits but perhaps chiefly for the protection of motors and generators.

UNDERLOAD: This is supplied for direct current only and its chief application is on battery charging circuits for the protection of the battery against accidental discharge through lowering or removal of charging voltage. An underload breaker will disconnect the battery when the charging current falls to 10% of circuit breaker rating.

UNDER-VOLTAGE: An under-voltage release opens the breaker when the line voltage fails and is generally used for the protection of motors against an unexpected resumption of power service. In many localities this type of release required by Public Service Corporations or Municipal regulations on all motor circuits where the total H. P. rating is in excess of a certain fixed minimum.

LARGER AND HIGHER VOLTAGE BREAKERS

Capacities not included in ROLLER-SMITH "Industrial" line are supplied in ROLLER-SMITH "Standard" breakers. See Bulletin No. 530 (sent on request).

BREAKER CAPACITY TABLE

The following table shows the ampere capacity of breakers to be used for the protection of motors. Necessarily average and not extreme values of motor efficiency had to be selected, but in general the table will be found conservative.

H.P.	D. C.			Single Phase A. C.		Two-Phase—4 Wire A. C.			Three Phase—3 Wire A. C.		
	Voltage			Voltage		Voltage			Voltage		
	110	220	500	110	220	110	220	440	110	220	440
1	10	5	3	15	10	10	5	3	10	5	3
2	30	10	5	30	15	15	10	5	15	10	5
3	30	15	10	45	30	30	15	5	30	15	10
5	45	30	10	60	30	30	15	10	45	20	10
7.5	60	30	20	80	45	45	30	10	45	30	20
10	80	45	30	100	60	60	30	20	60	30	20
15	150	60	30	150	80	80	45	20	80	45	30
20	150	80	45	200	100	100	60	30	100	60	30
25	200	100	45	200	100	150	60	45	150	80	45
30	300	150	60	300	150	150	80	45	150	80	45
50	400	200	80	500	300	300	150	80	300	150	80
75	600	300	150	600	400	400	200	100	400	200	100
100	800	400	200	800	500	500	300	150	500	300	150

Data for 2 phase, 3 wire motors furnished on application.

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WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

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ROLLER-SMITH Representatives

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CHICAGO	53 W. Jackson Blvd.	PHILADELPHIA	Otis Building
CLEVELAND	1988 E. 66th Street	PITTSBURGH	Westinghouse Bldg.
DENVER	Kittridge Bldg.	ST. LOUIS	Natl. Bk. of Com. Bldg.
DETROIT	Fisher Building	ST. PAUL	Pioneer Building
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LOS ANGELES	912 E. Third Street	SEATTLE	Alaska Bldg.
MONTREAL	Tramway Bldg.	TORONTO	183 George Street

A B R O A D

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MANILA MACHINERY & SUPPLY CO., INC.,	Box 607, Manila, Philippine Islands



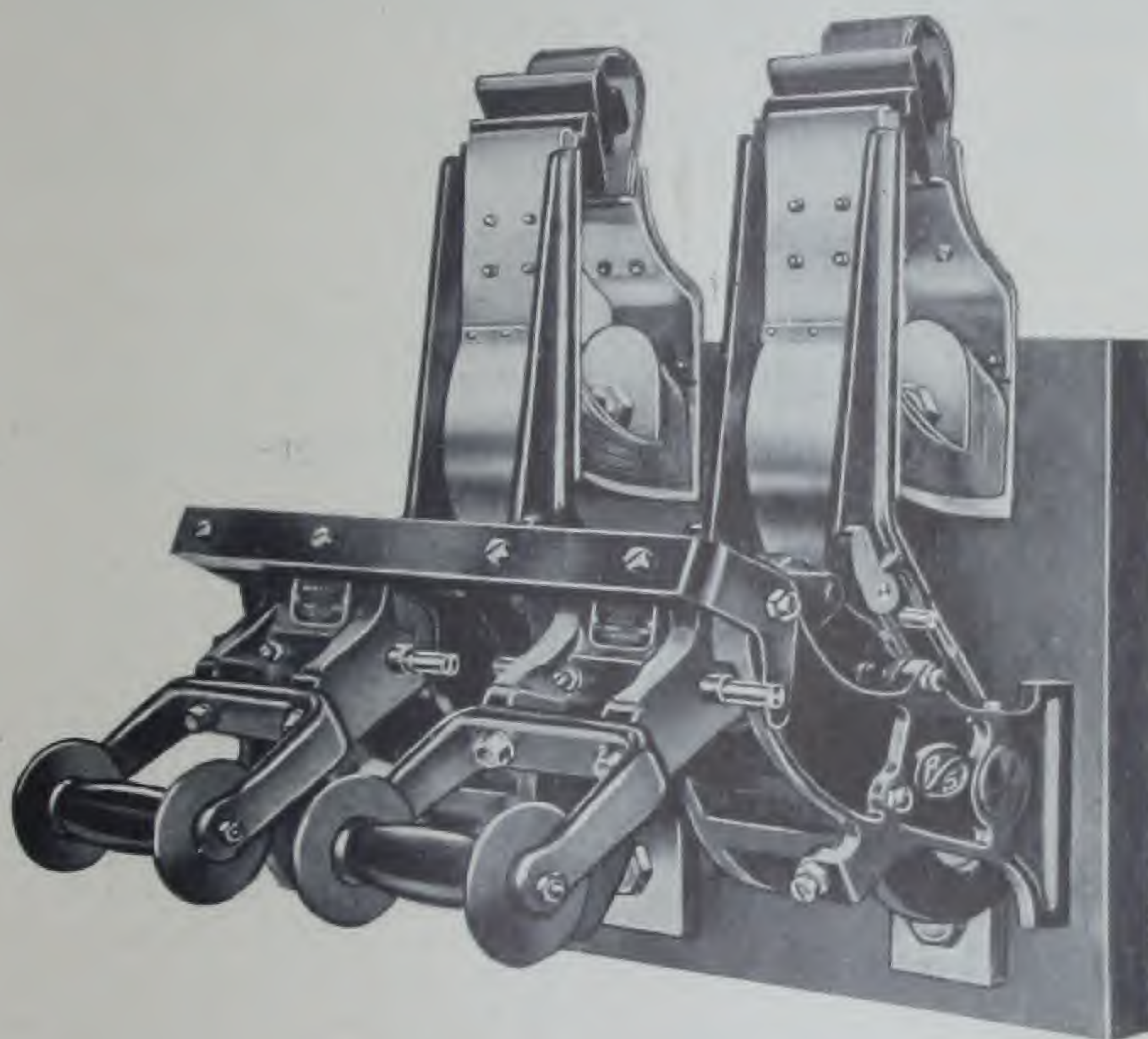
BULLETIN No. 530

October, 1928.

(Superseding issue dated August, 1926
Supplement No. 1 dated October, 1926
Supplement No. 2 dated February, 1928
and Supplement No. 3 dated
February, 1928)



"STANDARD" TYPE CIRCUIT BREAKERS



1200 ampere, 250 volt, 2 pole, independent arm, plain overload
circuit breaker with "interlocked trip"; back connections

ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

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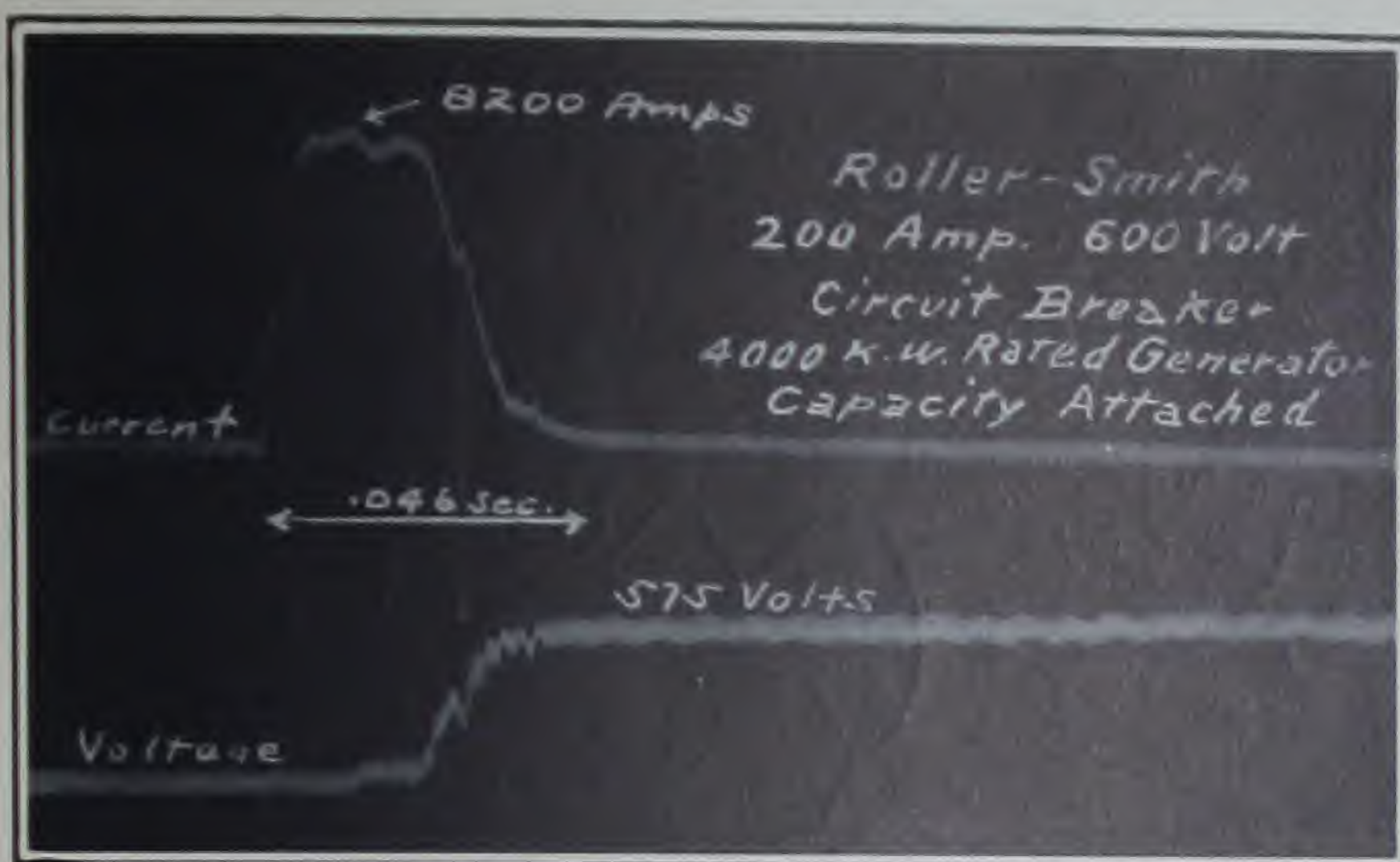
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ROLLER-SMITH

"Standard" Type Circuit Breakers

600 Volts and Less

DIRECT AND ALTERNATING CURRENT



This Oscillogram shows how, on an official test, a ROLLER-SMITH 200 ampere Standard Type circuit breaker opened a Direct Current circuit of 8200 amperes at 575 volts in .046 second

GENERAL. The succeeding pages describe and list a line of circuit breakers covering, we think, the entire range of requirements encountered in the air break circuit breaker field.

DESIGN. We have been careful throughout to select the most liberal cross sections of conducting parts, which, together with the fact that our structure involves a minimum number of joints and a maximum of radiating surface, means that the temperature rise under full load is extremely small. We have been just as careful with the design of the purely mechanical parts, choosing always large factors of safety so as to withstand the roughest handling which is apt to be encountered in every-day use. Another feature of importance to the user is our employment of non-rusting materials at all bearings and bearing surfaces, even the armature and central core pin, which are necessarily of iron in order that they may perform their magnetic functions, having their bearings brass or bronze bushed. These precautions insure freedom from all possibility of sticking.

APPEARANCE. While, generally speaking, appearance is a matter of taste, we think that it will be conceded that our apparatus as shown by the different illustrations thereof is handsome to a degree. It certainly looks well on any

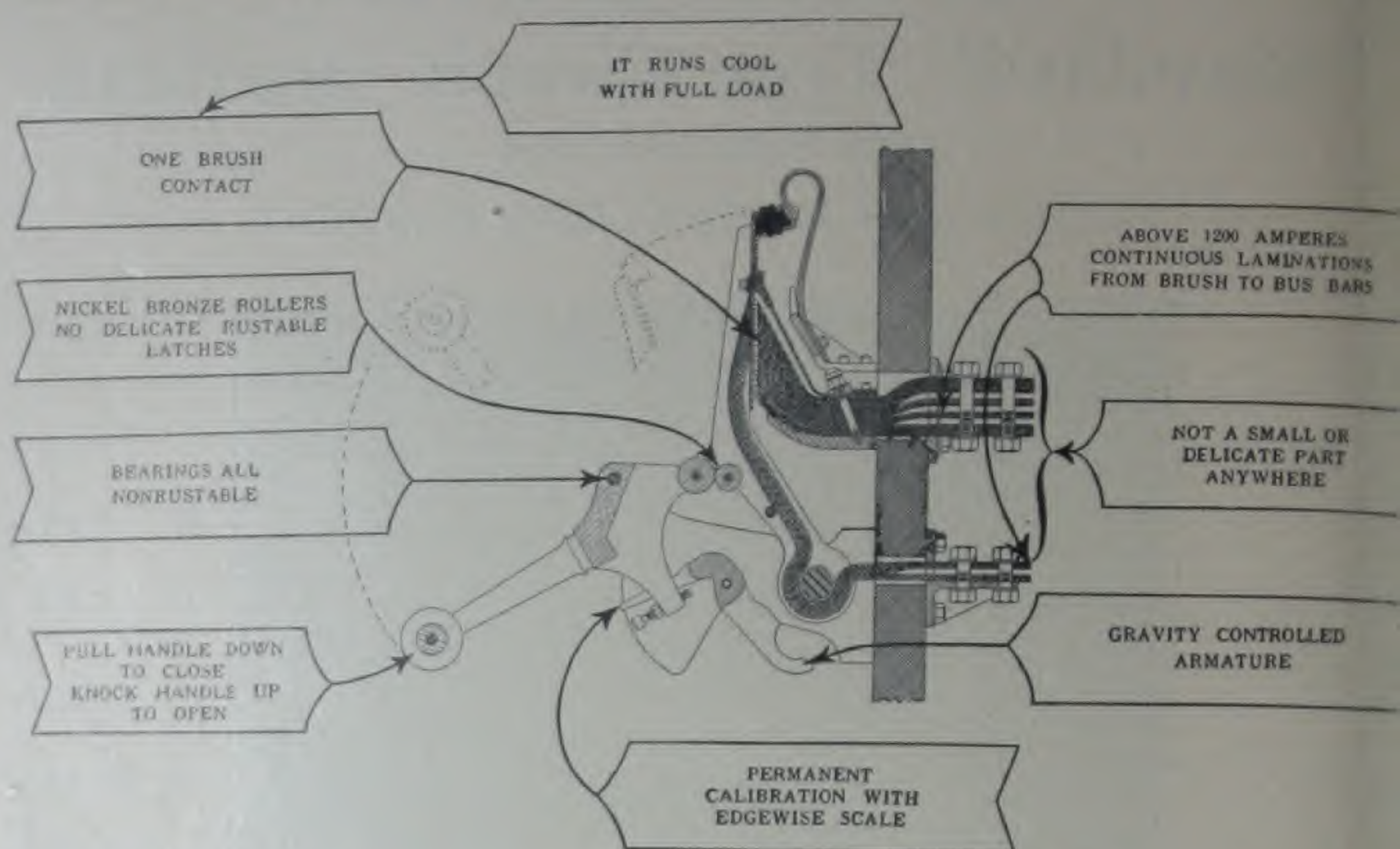
switchboard or panel and is doubly satisfying to the eye of the engineer who appreciates as well the quite apparent evidences of fitness for use.

All current carrying parts are of polished rolled copper, while all other parts of the mechanism, whose function is chiefly mechanical, are ground smooth and are given three coats of rubberoid black enamel, thoroughly baked on. The design is such that there is a minimum number of small parts to collect dust and dirt. All parts are very accessible and extremely easy to keep clean.

ADVANTAGES

QUICK-BREAKING. R-S breakers give the quickest of quick breaks because of the light arms and the powerful forces throwing them open. Three separate and distinct elements all tend to force the breaker open, any one of which has sufficient power to open the breaker alone. When the breaker is closed, the carbon spring, the main laminated brush of spring copper and the opening springs all tend to press outward, providing an unusual margin of safety against slow opening or sticking. The R-S breaker does not fall open from gravity, nor is its motion dependent alone on the short push which the heavy laminated contacts necessarily make.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKER



COMPACTNESS. The design of the R-S breaker is such as to give minimum width per pole, regardless of the kind and number of features called for on the breaker. With the R-S breaker the overload coil is always contained within the confines of the breaker housings and adds no width to the breaker. Likewise, undervoltage, shunt trip and free handle attachments are all contained within the width of the standard pole of breaker. The advantages of this design are twofold:

FIRST: The switchboard builder can keep his panel width down to a minimum.

SECOND: The space between adjacent poles is clear and not cluttered up with coils, attachments, etc.

RUGGEDNESS. All R-S breakers are held closed through the functioning of two bronze rollers, one of which passes over the centre of the other, forming a locking means of tremendous strength and at the same time one that can be opened with minimum power and no possibility of rusting or jamming.

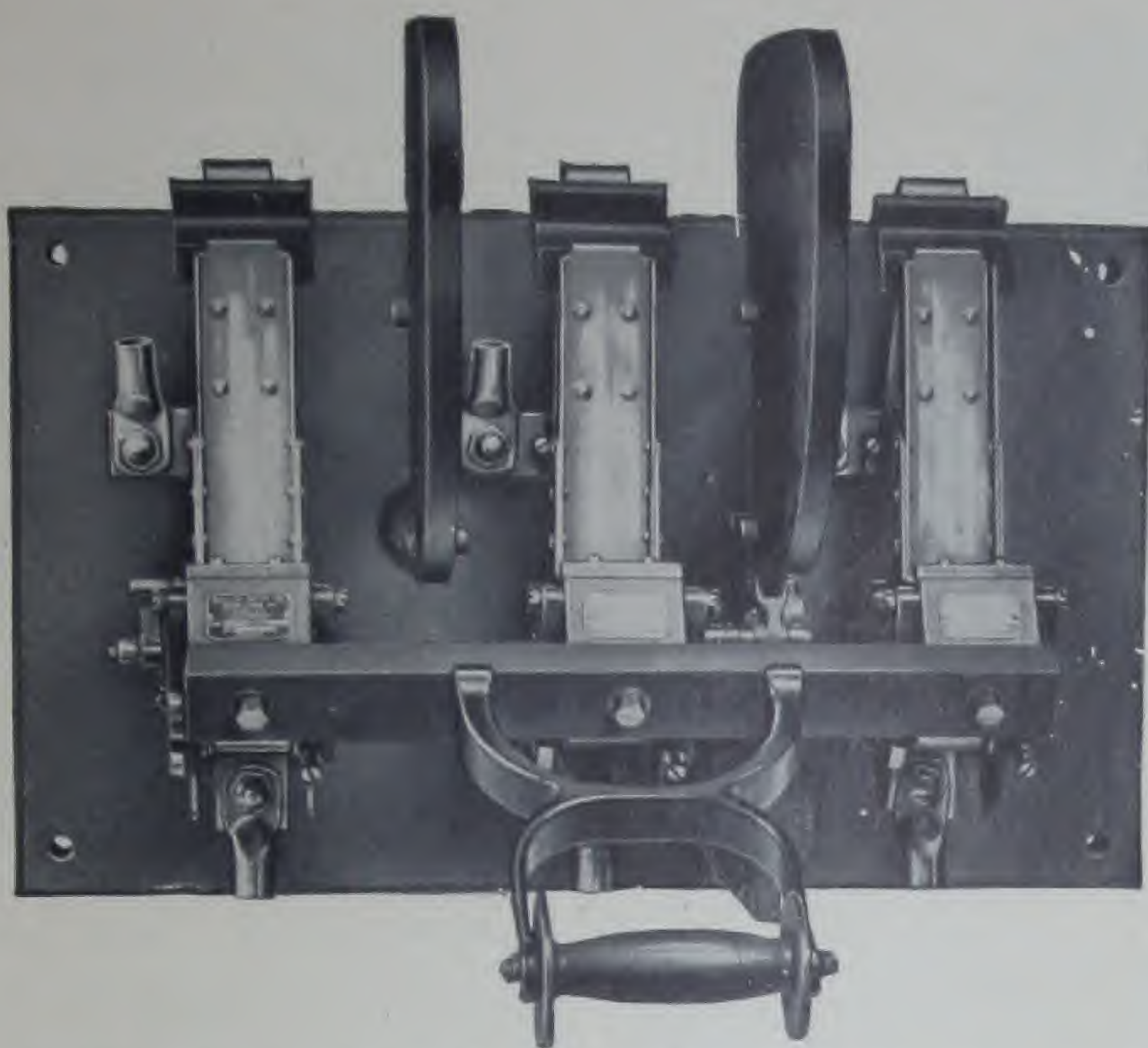
ACCURACY. All overload armatures on R-S breakers are gravity controlled. There are no springs to stretch and weaken and thus change the calibration. Overload adjustment can be accomplished by

the simple manipulation of a screw drive from the front of the breaker.

EASE IN REMOUNTING SWITCHBOARD BREAKERS. The fact that overload, undervoltage or shunt trip coils are all contained within the breaker housings, and supported by them, makes the remounting of R-S breakers on a switchboard a matter of greatest simplicity. In changing the breakers from shipping templates to the finished panel no change is made in the relationship between coils and tripping members, as would be the case where side mounted coils and attachments are employed. Also, a minimum number of holes are required in the switchboard.

An interesting example of the attainable simplicity is found in the breakers of a capacity of over 1200 amperes. Referring to the illustrations above and on page 9, it will be seen that here, instead of having a plurality of turns of the flexible strips around the magnetic core pin, a single turn suffices and that this turn is so made that the strips extend in one unbroken length from the free ends, which are split to receive the bus-bar, to the actual contact plate. Similarly, the laminations forming the brush are extended uninterrupted to form the upper terminal. No other breakers have as few parts as the ROLLER-SMITH.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS



200 ampere, 600 volt, 3 pole, rigid arm, combined overload and shunt-trip; with circuit opening auxiliary switch.

We call special attention to the fact that in our overload circuit breakers **each pole has its own protective coil, which, by reason of the compactness of the design, does not increase the overall width of the breaker.** This is in distinction to designs followed by some other manufacturers, who do not employ a coil for every pole, their designs being such that the overload coil is placed to one side of the breaker. This, in the case of three or four pole breakers, results in excessive width. The ROLLER-SMITH design is such that the overload coil in every case is included within the width of the contact members and this feature lends itself to a minimum width of the switchboard without in any way sacrificing safety or accessibility.

The advantage of having a coil to a pole is obvious when it is considered that the omission of an overload coil gives no protection between the unprotected leg and a ground in the case of short circuit. If an overload coil per pole is not provided 100% overload protection is not assured to the system involved.

ROLLER-SMITH circuit breakers require a minimum of attention for the following reasons:

The main contacts of laminated spring brush copper are self-cleaning to an unusual degree and their location is such

that inspection can be made readily without removing anything.

The carbon contacts are readily renewable, likewise the secondary contacts, on both the stationary brush and moving arm.

METHOD OF OPERATION. ROLLER-SMITH circuit breakers of all types are closed by pulling down on their handles and opened by knocking them upwards. This is a great advantage from an operating standpoint, as a slight upward blow will open a breaker with the speed of a quick-break switch. In an emergency the main breaker handle, being prominent, can be knocked open more readily than a small tripping knob can be located and operated. One of the outstanding features of R-S breakers is the ease with which they can be closed, this statement applying even to the largest sizes of multipole breakers. A 130 pound man can readily close the largest sizes of three and four pole breakers.

The breaker is held closed by the action of two rollers, one of which is attached to the moving contact arm and one to the handle member. These are so placed that when the handle is pulled down to the "closed" position the centre of the second roller is slightly above a line joining the handle axis and the arm roller.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS



100 ampere, 250 volt, single pole, plain overload, front connections

When the breaker is closed the compression of the main copper contacts, the secondary contacts and the carbon contacts are all such as to throw the device open. In addition to the pressure exerted by these three members phosphor bronze springs are placed against the moving arm on all breakers up to and including 1200 amperes. When the handle lever roller is moved below the centre of the arm roller all four of the above-mentioned members tend to throw the breaker open. In other words the R-S breaker does not simply fall open by gravity but is thrown open by the action of several members.

The overload tripping action is obtained by means of an iron armature, which, on being attracted to the core of the overload coil, delivers a blow to the handle element, forcing the handle roller down past centre, which permits the arm to fly open at high velocity. The main laminated contacts break first, a secondary copper contact breaks second and the carbon contacts finally rupture the arc. The arrangement of the overload coil is such that its field repels the arc upwards, thus blowing it away from the breaker. This is an important feature, eliminating as it does the need of magnetic blowouts, arc chutes and similar devices.

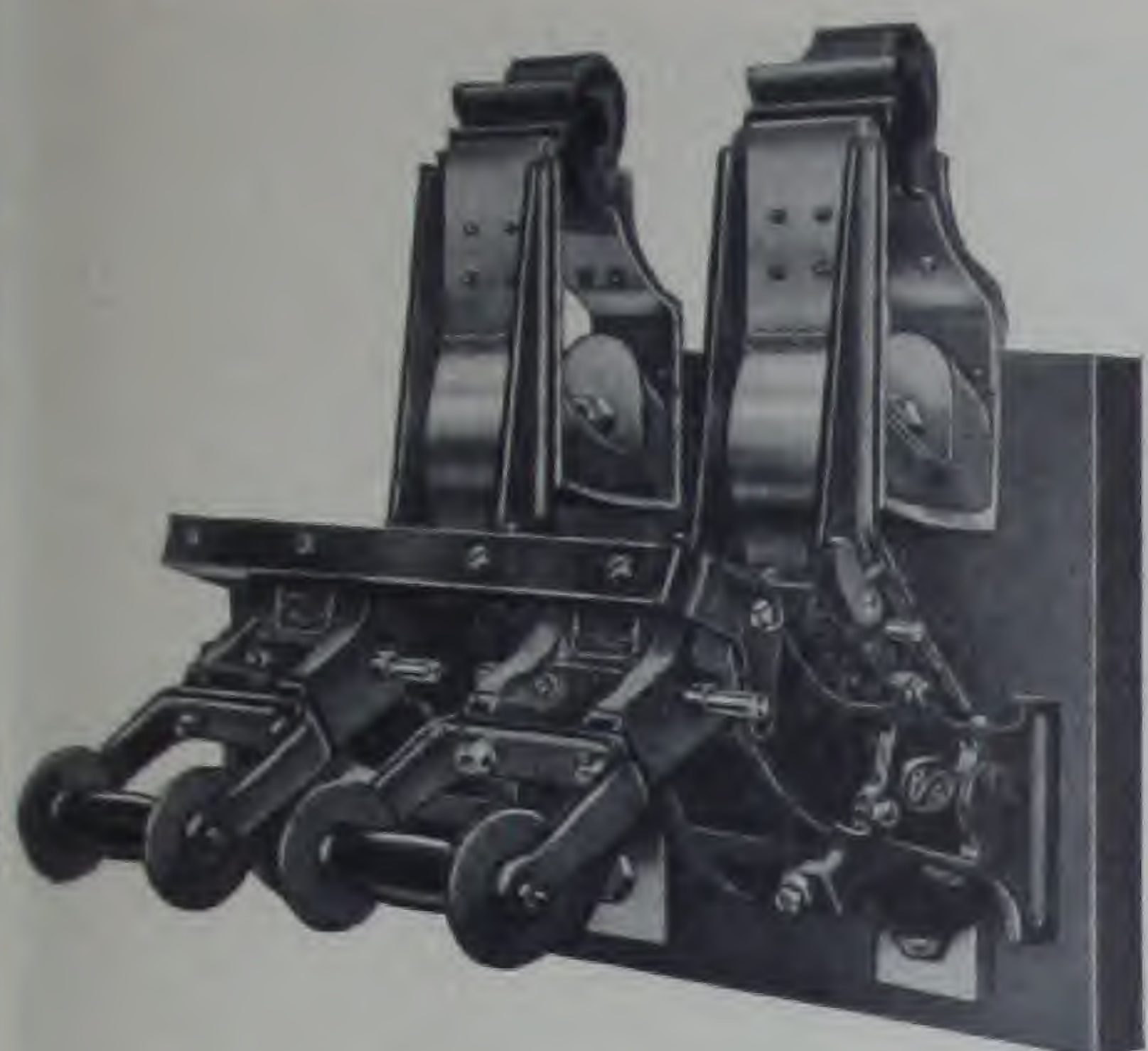
The ROLLER-SMITH breaker is not a "latch-held" breaker and rough operation of the breaker inflicts no damage on the moving parts, in contrast to a "latch-held" breaker, which often will be put out of service if the handle is given an upward blow when the breaker is closed.

SWITCHBOARD MOUNTING. Circuit breakers intended for switchboard mounting are arranged with back connection studs. Switchboard mounting breakers are shipped from the factory on either temporary wooden templates or slate bases, this being determined by the size and number of poles of the breakers. Drilling templates are provided, from which the layout of the holes can be determined. Circuit breakers in sizes of 1200 amperes and below are provided with round threaded terminal studs. One stud per pole is equipped with nuts and a cable terminal and the other stud is equipped with nuts only, this being in accordance with the practice of connecting the breaker direct to the bus bar on one side and using cables for the other. On sizes over 1200 amperes the breaker terminals are in the form of laminated studs. These laminated studs are built for the accommodation of standard $\frac{1}{4}$ -inch bus bars of a number sufficient for carrying the current of the breaker. If bus bars of thickness other than $\frac{1}{4}$ -inch are wanted, they can be supplied if mention is made of the fact at the time of ordering. Cable terminals for connecting terminals on to the laminated terminal studs can be supplied at a reasonable additional cost. Terminals accommodating from one to four cables suitable for upper or lower terminal and for any of the combinations of cable sizes likely to be specified can be furnished. Spare part sheets giving dimensions and data on these cable terminals will be supplied on request.

WALL MOUNTING. Where circuit breakers of 1200 amperes capacity, or less, are not to be mounted on switchboards, but are to be left on their bases and mounted on a wall or its equivalent, R-S breakers are supplied in front connected type of mounting at a nominal extra charge. The front connected breaker is mounted on a finished, beveled edge, black marine slate, drilled with four corner holes for securing to the wall. Connections to the breaker are made on the front and polished copper cable lugs are furnished for each terminal.

Breakers over 1200 amperes capacity are regularly furnished only in the switchboard style of mounting, but can be supplied on finished panels at a small extra charge, thus enabling the mounting of breakers for other than switchboard work.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS



1200 ampere, 250 volt, 2 pole, independent arm, plain overload with "Interlocked Trip," back connections

SINGLE POLE BREAKERS. Single pole breakers may be used for the protection of a single wire, or grouped to protect two or more wires of one circuit.

TWO POLE, INDEPENDENT ARM, INTERLOCKED TRIP BREAKERS.

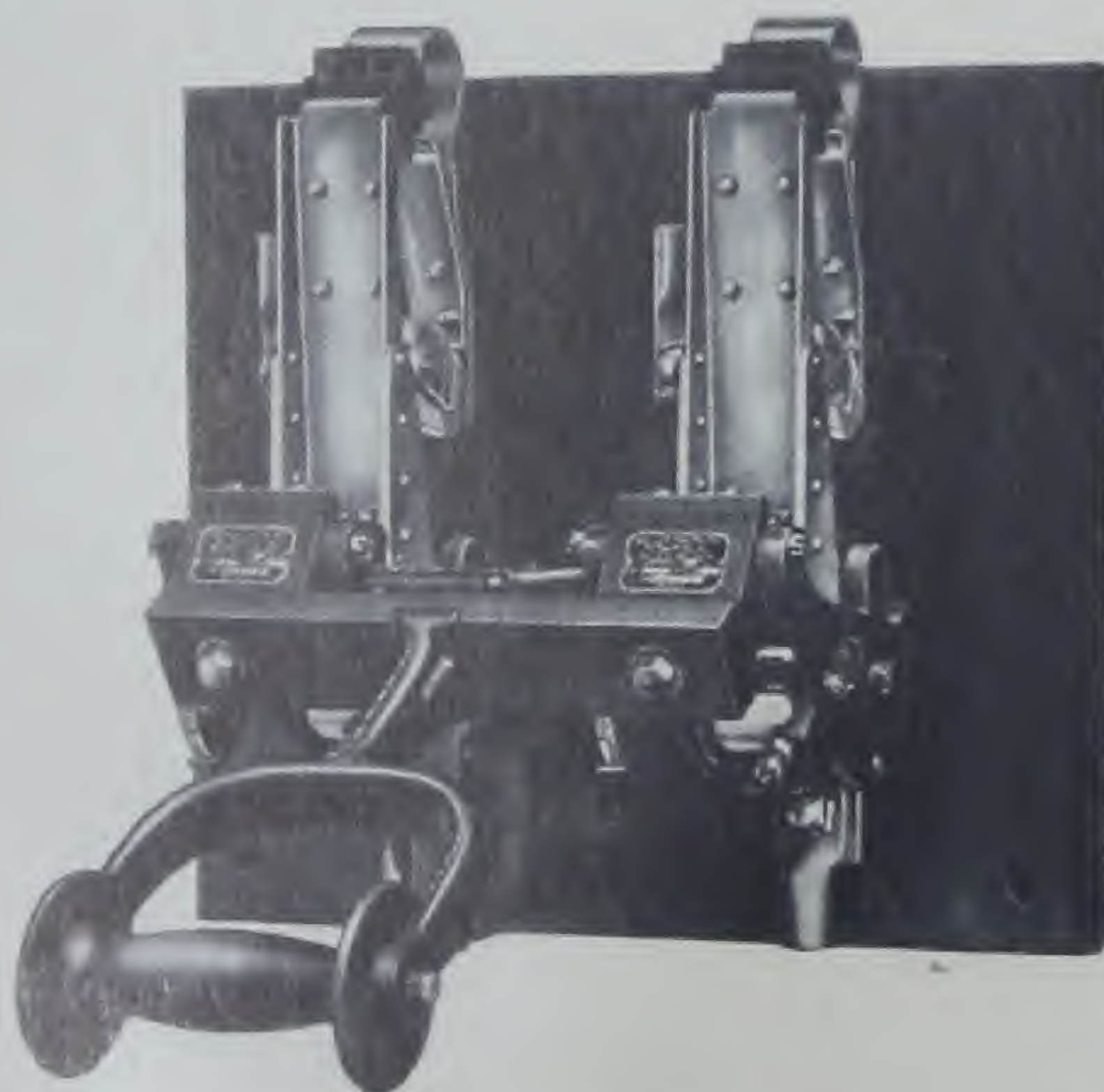
By the use of a two pole, independent arm, interlocked trip breaker it is possible to close one pole independently of the other, but upon the occurrence of an overload, both poles trip out. The successive closing of the two poles thus insures protection against holding the line closed with an overload on. This arrangement also eliminates the need of a switch in connection with the breaker and makes for a more uniform layout than is the case when switches and breakers are grouped together. If it is desired to have the two poles open and close simultaneously, a Free Handle rigid arm breaker should be used. All two pole, independent arm breakers, unless otherwise stated, will be supplied of the interlocked trip type which, as stated above, permits of the separate closing of the two poles.

MULTIPOLE RIGID ARM BREAKERS. There are many conditions of operation, notably 3 and 4 wire A. C. systems, when it is necessary that all the legs of the circuit be opened or closed simultaneously, so that, when an overload occurs on one leg of the circuit, the breaker will disconnect all legs simultaneously. For such conditions we supply the rigid arm model, which consists in brief of the requisite number of independent units, whose handle mechanisms are tied to-

gether by a cross bar of insulating material. Obviously, the operation of a single handle permits simultaneous closing and the operation of any one overload coil results in simultaneous opening of all poles.

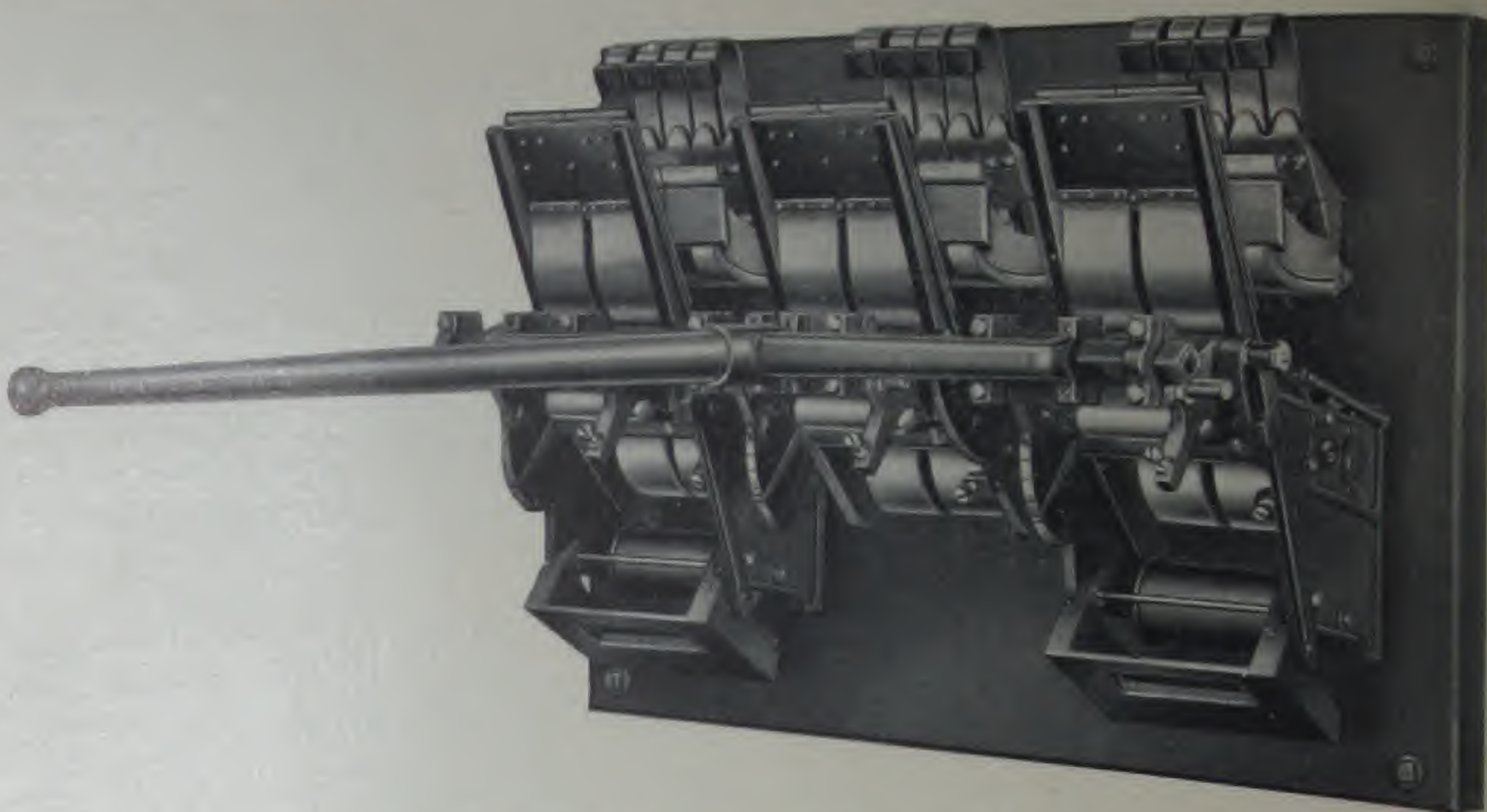
BARRIERS. All multipole breakers for use on voltages over 250 volts are equipped with asbestos barriers, which are located between the poles so as to prevent arcing across. These barriers are all readily removable from the front of the slate.

TYPES OF HANDLES. All single pole and multipole, interlocked trip breakers up to 200 amperes capacity have straight handles. Breakers from 300 to 1200 amperes capacity are provided with spade handles. All multipole, rigid arm breakers up to 1200 amperes inclusive have spade handles, except the 1000 and 1200 ampere four pole, which are equipped with removable handles. All breakers of 1500 amperes and over of single pole type are equipped with spade handle. Breakers of 1500 amperes and over of multipole, rigid connected type are equipped with removable handles. The removable handle is of sufficient length to give ample leverage for the easy closing of the largest breakers. The removable feature is highly desirable, in that it avoids the long handle projecting from the front of the switchboard, which might be accidentally bumped into by passers-by. Also, a long fixed handle is a menace to switchboard attendants, who might be in its path during an overload.



200 ampere, 250 volt, 2 pole, rigid arm, combined overload and under-voltage

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS



3000 ampere, 250 volt, 3 pole, rigid arm,
combined overload and under-voltage

CURRENT CARRYING PARTS. The current carrying members of all R-S breakers are built either from rolled bar copper, copper wire, or rolled copper sheets. No castings are employed for any part of the circuit. All joints employing solder are also riveted or screwed.

AMPERE RATINGS. Ampere ratings given refer to the safe continuous capacity of the breaker without undue heating. Breaker capacities should be selected so that they will be equal to or higher than the maximum normal current.

CUSHIONING. All sizes of R-S breakers are remarkably free from rebound troubles. On the larger sizes (1000 amperes or over, where special cushioning is desirable) a cam shaped, spring controlled latch engages the contact arm at the open limits of its travel in such fashion as to cushion the member and, at the same time, prevent its rebound. No rubber bumpers are employed on any of the sizes as this material becomes deficient in both durability and cushioning properties after a short period of use.

FINISH. All breakers are regularly supplied with the current carrying parts in polished copper and with the remaining metal parts in dead black. There are but two colors in the ROLLER-SMITH breaker installation, i.e., either polished copper, or dead black. Insulating material, fibre cross bars, wood handles, etc., are all black.

SPECIAL BREAKERS. The field for special breakers is so wide that it is obviously impossible to attempt to describe their possibilities in a brief bulletin of this sort. It might be noted, however, that standard breakers with slight modifications can many times be adapted to cover many special requirements and we are always glad of an opportunity to quote on special installations and endeavor in such cases to utilize standard types as far as possible in order to keep the cost to the purchaser down to a minimum.

INSPECTION AND ADJUSTMENT. Every R-S breaker from the smallest to the largest is individually calibrated with current of the same frequency (if A. C.) as the specifications called for. Each pole of every breaker regardless of size, is given a serial number and against that serial number is recorded an imprint of the contact surfaces, the millivolt drop across the break, watt consumption of tripping coils, etc. This procedure not only assures that the purchaser is getting exactly the breaker called for but that each individual breaker comes within the limitations set forth by the Engineering Department. If servicing of the breaker should be necessary at some distant date complete data is at hand, which enables replacement parts to be furnished without loss of time.

UNDERWRITERS' APPROVAL. All ROLLER-SMITH breakers have the official approval of the National Board of Fire Underwriters.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

OVERLOAD CIRCUIT BREAKERS



1500 ampere, 250 volt, single pole, plain overload, back connections

DESCRIPTION. The overload feature consists of a series coil, formed by the spirally-wound conductors in the lower part of the moving arm and a gravity-controlled, "U"-shaped armature which is adjustable as to its length of angular travel. The passage of the main current through the coil energizes the iron core passing through its center, which in turn exerts a magnetic pull on the armature. When the current reaches the predetermined value for which the armature is set the latter is caused to rise with great and increasing speed until it strikes the releasing device. The breaker then flies open.

CALIBRATION. Range of overload calibration is from rated capacity to twice rated capacity; for example, a 100 ampere breaker has a range of from 100 to 200 amperes. The overload can readily be set at any point between the two limits by means of an adjusting screw provided for that purpose. On special propositions we can supply circuit breakers

with a range of overload calibration **below** normal rating and **above** twice normal rating. Details on application.

APPLICATION. As its name indicates, the function of the plain overload circuit breaker is automatically to interrupt the circuit in which it is placed when the flow of current exceeds the predetermined limit for which the breaker is set. It is the most common of all the types and is utilized for the protection of generators and motors and all other electrical apparatus which, by reason of the conditions of operation, may become subject to loads in excess of the normal.

ROLLER-SMITH circuit breakers may be fully depended upon for the complete protection of the lines which they are to safeguard against all abnormal conditions which may arise. They are far superior to fuses, not only in that they always perform their functions without requiring replacement as do fuses, but because they may be reset in an instant, thus saving much valuable time.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKER

OVERLOAD

*1200 AMPERES AND UNDER
**BACK CONNECTED

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT OR ALTERNATING CURRENT									
	Cat. No.	1 Pole	Cat. No.	†2-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
5	53000	\$ 25.50	53034	\$ 57.00	53068	\$ 57.00	53102	\$ 88.50	53136	\$120.00
10	53002	25.50	53036	57.00	53070	57.00	53104	88.50	53138	120.00
20	53004	25.50	53038	57.00	53072	57.00	53106	88.50	53140	120.00
30	53006	25.50	53040	57.00	53074	57.00	53108	88.50	53142	120.00
45	53008	25.50	53042	57.00	53076	57.00	53110	88.50	53144	120.00
60	53010	25.50	53044	57.00	53078	57.00	53112	88.50	53146	120.00
80	53012	25.50	53046	57.00	53080	57.00	53114	88.50	53148	120.00
100	53014	34.00	53048	76.00	53082	76.00	53116	116.00	53150	156.00
150	53016	34.00	53050	76.00	53084	76.00	53118	116.00	53152	156.00
200	53018	34.00	53052	76.00	53086	76.00	53120	116.00	53154	156.00
300	53020	59.00	53054	130.00	53088	130.00	53122	195.00	53156	260.00
400	53022	59.00	53056	130.00	53090	130.00	53124	195.00	53158	260.00
500	53024	59.00	53058	130.00	53092	130.00	53126	195.00	53160	260.00
600	53026	77.50	53060	161.00	53094	161.00	53128	251.00	53162	344.00
800	53028	105.00	53062	222.00	53096	222.00	53130	333.00	53164	454.00
1000	53030	155.00	53064	335.00	53098	335.00	53132	500.00	53166	665.00
1200	53032	160.00	53066	345.00	53100	345.00	53134	515.00	53168	680.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT OR ALTERNATING CURRENT (Barriers between Poles)									
	Cat. No.	1 Pole	Cat. No.	†2-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
5	53170	\$ 25.50	53204	\$ 61.00	53238	\$ 61.00	53272	\$ 96.50	53306	\$132.00
10	53172	25.50	53206	61.00	53240	61.00	53274	96.50	53308	132.00
20	53174	25.50	53208	61.00	53242	61.00	53276	96.50	53310	132.00
30	53176	25.50	53210	61.00	53244	61.00	53278	96.50	53312	132.00
45	53178	25.50	53212	61.00	53246	61.00	53280	96.50	53314	132.00
60	53180	25.50	53214	61.00	53248	61.00	53282	96.50	53316	132.00
80	53182	25.50	53216	61.00	53250	61.00	53284	96.50	53318	132.00
100	53184	34.00	53218	80.00	53252	80.00	53286	124.00	53320	168.00
150	53186	34.00	53220	80.00	53254	80.00	53288	124.00	53322	168.00
200	53188	34.00	53222	80.00	53256	80.00	53290	124.00	53324	168.00
300	53190	59.00	53224	134.00	53258	134.00	53292	203.00	53326	272.00
400	53192	59.00	53226	134.00	53260	134.00	53294	203.00	53328	272.00
500	53194	59.00	53228	134.00	53262	134.00	53296	203.00	53330	272.00
600	53196	77.50	53230	165.00	53264	165.00	53298	259.00	53332	356.00
800	53198	105.00	53232	226.00	53266	226.00	53300	341.00	53334	466.00
1000	53200	155.00	53234	339.00	53268	339.00	53302	508.00	53336	677.00
1200	53202	160.00	53236	349.00	53270	349.00	53304	523.00	53338	692.00

*For higher capacities see pages 11 and 12.

**For front connected see note below.

†Two-pole, independent arm breakers can be supplied **without** the interlocked trip feature desired. The price of such a breaker is exactly **twice** that of a single pole breaker of the desired specifications except that where breakers for potentials over 250 volts are involved there is an **addition** of \$4.00 for barriers between poles.

In ordering, specify catalog number, style of mounting, whether for A. C. or D. C. and, if for A. C., the frequency and number of phases and wires.

All the catalog numbers shown on this page cover **switchboard mounting** breakers only. Catalog numbers covering **front connected** breakers are the same as the ones listed except that the first numeral of each catalog number is "6" instead of "5." For example, Catalog No. 53000 is a 5 ampere, 250 volt, single pole, plain overload **back connected** breaker for **switchboard mounting** and Catalog No. 63000 is a corresponding breaker, **front connected** for **wall mounting**. **Add 15% to printed list prices for front connections.

In ordering the breakers listed on this page, be sure to specify the catalog number which corresponds to the mounting wanted, and style of mounting should be specified as well so as to eliminate any possibility of error.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

OVERLOAD (Continued)
1500 AMPERES AND OVER
**BACK CONNECTED

*600 VOLTS AND UNDER, DIRECT CURRENT ONLY										
Rated Ampere Capacity	Cat. No.	1 Pole	Cat. No.	†2-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
1500	53400	\$ 256.00	53424	\$ 512.00	53448	\$ 512.00	53472	\$ 768.00	53496	\$1024.00
1800	53402	267.00	53426	534.00	53450	534.00	53474	801.00	53498	1068.00
2000	53404	284.00	53428	568.00	53452	568.00	53476	852.00	53500	1136.00
2500	53406	400.00	53430	800.00	53454	800.00	53478	1200.00	53502	1600.00
3000	53408	410.00	53432	820.00	53456	820.00	53480	1230.00	53504	1640.00
4000	53410	1100.00	53434	1200.00	53458	1200.00	53482	2130.00	53506	2840.00
5000	53412	855.00	53436	1710.00	53460	1710.00	53484	2565.00	53508	3420.00

† For 250 Volts and under, see below.

250 VOLTS AND UNDER, DIRECT CURRENT ONLY										
Rated Ampere Capacity	Cat. No.	1 Pole	Cat. No.	†2-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
4000	53414	\$ 690.00	53438	\$1380.00	53462	\$1380.00	53486	\$2070.00	53510	\$2760.00
5000	53416	710.00	53440	1420.00	53464	1420.00	53488	2130.00	53512	2840.00
6000	53417	800.00	53441	1600.00	53465	1600.00	53489	2400.00	53513	3200.00
7000	53418	855.00	53442	1710.00	53466	1710.00	53490	2565.00	53514	3420.00
8000	53419	1335.00	53443	2670.00	53467	2670.00	53491	4005.00	53515	5340.00
10000	53420	1100.00	53444	3200.00	53468	3200.00	53492	4800.00	53516	6400.00
12000	53422	1780.00	53446	3560.00	53470	3560.00	53494	5340.00	53518	7120.00

*600 VOLTS AND UNDER, ALTERNATING CURRENT ONLY											
Rated Amp. Capacity	Cycles	Cat. No.	1 Pole	Cat. No.	†2-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
1500	25	53520	\$ 256.00	53556	\$ 512.00	53592	\$ 512.00	53628	\$ 768.00	53664	\$1024.00
	60	53522	267.00	53558	534.00	53594	534.00	53630	801.00	53666	1068.00
1800	25	53524	267.00	53560	534.00	53596	534.00	53632	801.00	53668	1068.00
	60	53526	284.00	53562	568.00	53598	568.00	53634	852.00	53670	1136.00
2000	25	53528	284.00	53564	568.00	53600	568.00	53636	852.00	53672	1136.00
	60	53530	400.00	53566	800.00	53602	800.00	53638	1200.00	53674	1600.00
2500	25	53532	410.00	53568	820.00	53604	820.00	53640	1230.00	53676	1640.00
	60	53534	410.00	53570	820.00	53606	820.00	53642	1230.00	53678	1640.00
3000	25	53536	586.00	53572	1172.00	53608	1172.00	53644	1758.00	53680	2344.00
	60	53538	586.00	53574	1172.00	53610	1172.00	53646	1758.00	53682	2344.00
3500	25	53540	586.00	53576	1172.00	53612	1172.00	53648	1758.00	53684	2344.00
	60	53542	755.00	53578	1510.00	53614	1510.00	53650	2365.00	53686	3020.00
4000	25	53544	755.00	53580	1510.00	53616	1510.00	53652	2365.00	53688	3020.00
	60	53546	855.00	53582	1710.00	53618	1710.00	53654	2565.00	53690	3420.00
5000	25	53548	1155.00	53584	2310.00	53620	2310.00	53656	3465.00	53692	4620.00
	60	53550	On Appl.	53586	On Appl.	53622	On Appl.	53658	On Appl.	53694	On Appl.
6000	25	53552	1335.00	53588	2670.00	53624	2670.00	53660	4005.00	53696	5340.00
	60	53554	On Appl.	53590	On Appl.	53626	On Appl.	53662	On Appl.	53698	On Appl.

* Where operating voltage is over 250 volts, barriers between adjacent poles of multi-pole breakers are supplied without extra charge.

† Two-pole, independent arm breakers can be supplied without the "interlocked trip" feature if desired. The price of such a breaker is exactly twice that of a single pole breaker of the desired specifications.

In ordering, specify catalog number, style of mounting, thickness of panel, whether for A. C. or D. C., and, if for A. C., the frequency and number of phases and wires. All the catalog numbers shown on this page cover switchboard mounting breakers only. **Capacities over 1200 amperes are supplied only with back connections, either with temporary bases where such breakers are to be remounted on switchboards, or, at a slight extra charge, with finished slate bases where remounting on switchboards is not involved. See page 6.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

OVERLOAD (Continued)

1500 AMPERES AND OVER

All breakers of 1500 amperes capacity and over have laminated rear studs especially suitable for switchboard mounting. Front connections cannot usually be supplied for these capacities. See page 6.

UNDER-VOLTAGE AND SHUNT-TRIP

Combined Overload and Under-Voltage and Combined Overload and Shunt-Trip. Add to price of overload breaker the list price of the appropriate attachment, as shown below.

Plain Under-Voltage and Plain Shunt-Trip. These take same prices as when combined with overload. See preceding paragraph.

In ordering, specify catalog number, style of mounting, actual operating voltage, and, if A. C., frequency and number of phases and wires.

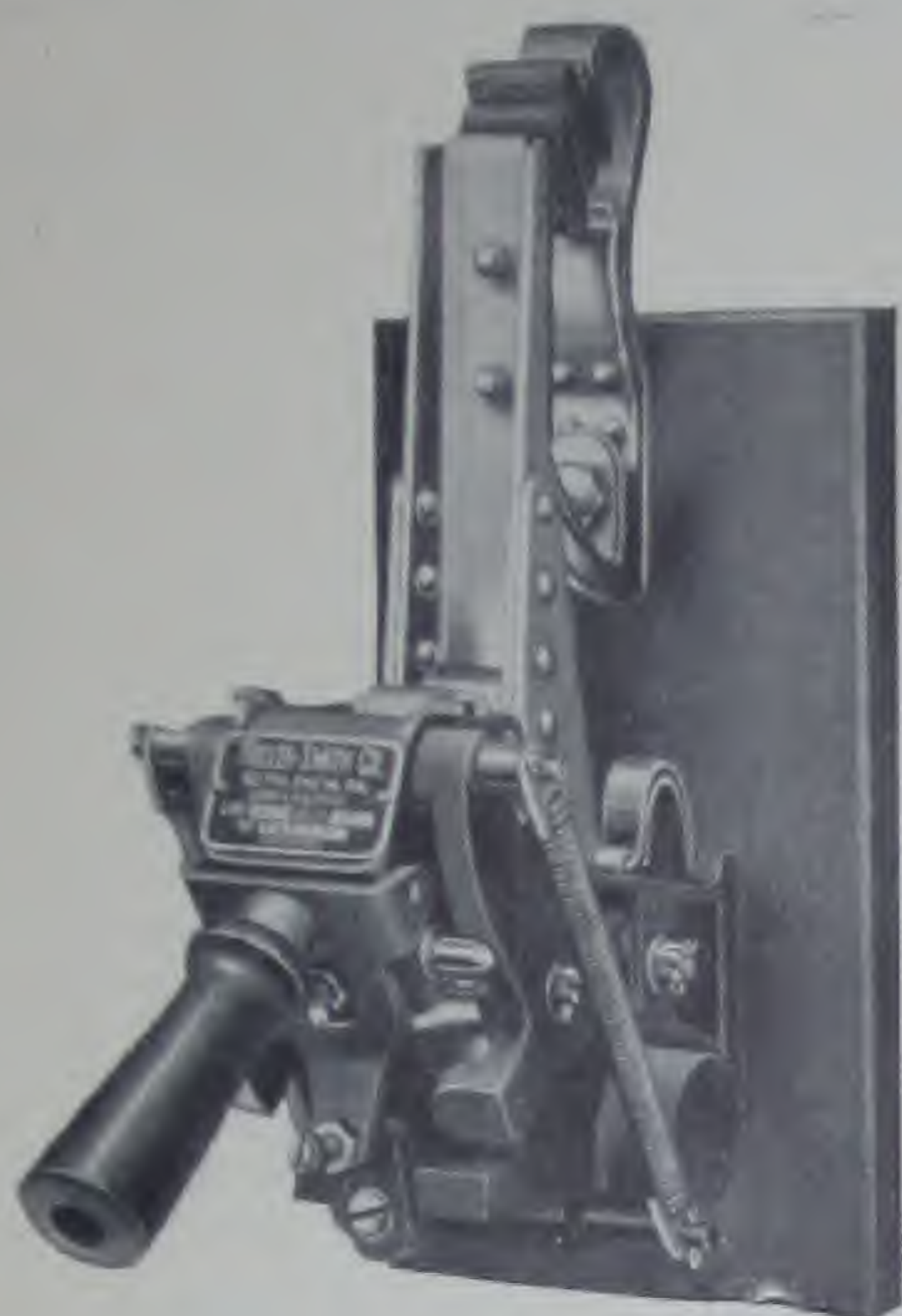
Note: Three pole breakers for 2 phase, 3 wire service should have the middle pole about $1\frac{1}{2}$ times the capacity of the outside poles. Price is usually the same as for a regular 3 pole breaker of same capacity as middle pole of breaker desired. Prices quoted on application.

SPECIAL ATTACHMENTS FOR BREAKERS OVER 1200 AMPERES

Circuit Breakers	Under-Voltage		Shunt-Trip	
	Cat. No.	List Price	Cat. No.	List Price
SINGLE AND DOUBLE POLE				
D. C. 1500- 3000 Amperes	53350	\$60.50	53370	\$60.50
D. C. 4000- 6000 Amperes	53351	77.00	53371	77.00
D. C. 7000-12000 Amperes	53352	99.00	53372	99.00
A. C. 1500-2500 Amperes	53353	60.50	53373	60.50
A. C. 3000-4000 Amperes	53354	77.00	53374	77.00
A. C. 5000-6000 Amperes	53355	99.00	53375	99.00
THREE AND FOUR POLE				
D. C. 1500-3000 Amperes	53356	†121.00	53376	60.50
D. C. 4000-6000 Amperes	53357	†154.00	53377	77.00
D. C. 7000-12000 Amperes	53358	†198.00	53378	99.00
A. C. 1500-2500 Amperes	53359	†121.00	53379	60.50
A. C. 3000-4000 Amperes	53360	†154.00	53380	77.00
A. C. 5000-6000 Amperes	53361	†198.00	53381	99.00

† Two under-voltage coils are supplied.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS



50 ampere, 250 volt, single pole, plain underload

UNDERLOAD CIRCUIT BREAKERS

DESCRIPTION. This type of release is designed to open the breaker when the current **falls** to a predetermined **minimum** value. The construction is somewhat similar to the overload type. The armature, however, is considerably heavier and is pushed to its upper limit of travel by the action of closing the breaker. If the current is sufficiently over the minimum value the armature is held up by the magnetic force of the series coil; if the current is below that value, the breaker will not remain closed, as there is then not sufficient magnetic attraction to hold up the armature. If, with the breaker closed, the current falls below the minimum value, the magnetic attraction of the series coil decreases and the armature drops down, thus actuating the releasing mechanism.

TRIPPING POINT. The underload feature is normally adjusted by the factory so that it functions when the current falls to about 10% of its rated value.

It may, however, be adjusted by the user to a somewhat lower or higher point.

APPLICATION. The underload circuit breaker is generally used in connection with storage battery installations, where it is not infrequently the case that, because of speed variations of the means driving the charging generator, improper manipulation of the generator rheostat or the like, the charging current falls to too low a value, which condition, if carried further, would permit the batteries to discharge and so run the generator as a motor. A still more serious possibility often lies in the shutting down of the charging source without first disconnecting the batteries, which, without automatic means of disconnection when the current becomes too low, would mean a discharging of the cells through the circuit which is left, with the consequent rapid exhaustion and injury of the cells. The underload breaker protects against all this.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

PLAIN UNDERLOAD AND COMBINED OVERLOAD AND UNDERLOAD *BACK CONNECTED

250 VOLTS AND UNDER, DIRECT CURRENT ONLY								
Rated Ampere Capacity	Cat. No.	1-Pole Plain Underload	Cat. No.	1-Pole Over and Underload	Cat. No.	2-Pole Ind'p't Arm Inter. Trip 1-Pole Plain Overload 1-Pole Over and Underload	Cat. No.	2-Pole Rigid Arm 1-Pole Plain Overload 1-Pole Over and Underload
5	53700	\$38.25	53740	PRICES ON APPLICATION	53780	PRICES ON APPLICATION	53820	PRICES ON APPLICATION
10	53702	38.25	53742		53782		53822	
15	53704	38.25	53744		53784		53824	
20	53706	38.25	53746		53786		53826	
30	53708	38.25	53748		53788		53828	
45	53710	38.25	53750		53790		53830	
60	53712	38.25	53752		53792		53832	
80	53714	38.25	53754		53794		53834	
100	53716	51.00	53756		53796		53836	
150	53718	51.00	53758		53798		53838	
200	53720	51.00	53760		53800		53840	
300	53722	88.50	53762		53802		53842	
400	53724	88.50	53764		53804		53844	
500	53726	88.50	53766		53806		53846	
600	53728	103.50	53768		53808		53848	
800	53730	157.50	53770		53810		53850	
250-600 VOLTS, DIRECT CURRENT ONLY (Barriers between Poles)								
Rated Ampere Capacity	Cat. No.	1-Pole Plain Underload	Cat. No.	1-Pole Over and Underload	Cat. No.	2-Pole Ind'p't Arm Inter. Trip 1-Pole Plain Overload 1-Pole Over and Underload	Cat. No.	2-Pole Rigid Arm 1-Pole Plain Overload 1-Pole Over and Underload
5	53860	\$38.25	53900	PRICES ON APPLICATION	53932	PRICES ON APPLICATION	53964	PRICES ON APPLICATION
10	53862	38.25	53902		53934		53966	
15	53864	38.25	53904		53936		53968	
20	53866	38.25	53906		53938		53970	
30	53868	38.25	53908		53940		53972	
45	53870	38.25	53910		53942		53974	
60	53872	38.25	53912		53944		53976	
80	53874	38.25	53914		53946		53978	
100	53876	51.00	53916		53948		53980	
150	53878	51.00	53918		53950		53982	
200	53880	51.00	53920		53952		53984	
300	53882	88.50	53922		53954		53986	
400	53884	88.50	53924		53956		53988	
500	53886	88.50	53926		53958		53990	
600	53888	103.50	53928		53960		53992	
800	53890	157.50	53930		53962		53994	

*See note on page 15 for front connected.

See page 15 for further listings of underload circuit breakers and directions for ordering.

ROLLER=SMITH "STANDARD" TYPE CIRCUIT BREAKERS

COMBINED OVERLOAD AND UNDERLOAD

**BACK CONNECTED

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT CURRENT ONLY			
	Cat. No.	2-Pole Ind'p't Arm Inter. Trip 1-Pole Plain Overload 1-Pole Plain Underload	Cat. No.	2-Pole Rigid Arm 1-Pole Plain Overload 1-Pole Plain Underload
5	53781	\$69.75	53812	\$69.75
10	53783	69.75	53813	69.75
15	53785	69.75	53814	69.75
20	53787	69.75	53815	69.75
30	53789	69.75	53816	69.75
45	53791	69.75	53817	69.75
60	53793	69.75	53818	69.75
80	53795	69.75	53819	69.75
100	53797	91.00	53821	91.00
150	53799	91.00	53823	91.00
200	53801	91.00	53825	91.00
300	53803	159.50	53827	159.50
400	53805	159.50	53829	159.50
500	53807	159.50	53831	159.50
600	53809	193.00	53833	193.00
800	53811	274.50	53835	274.50

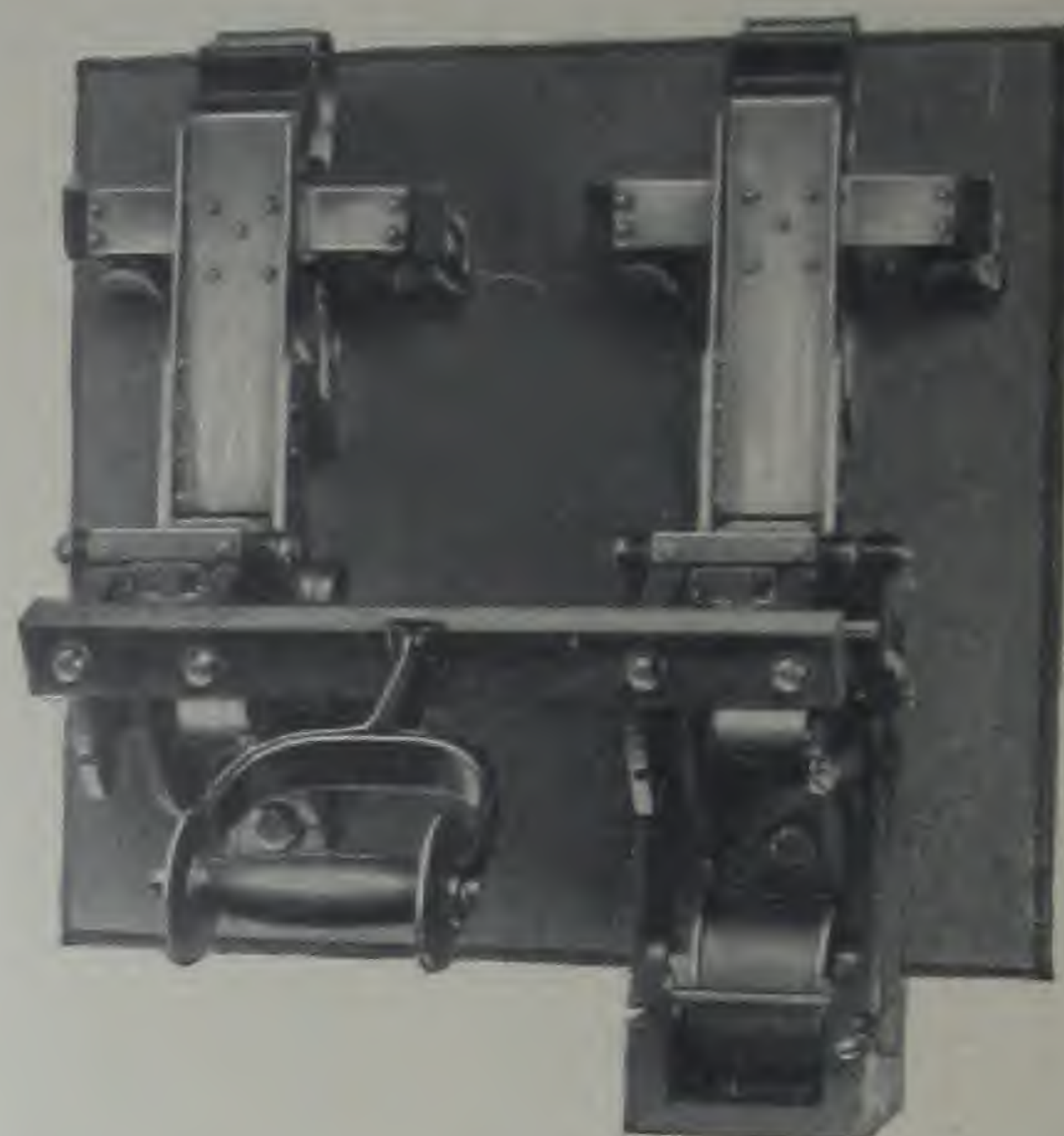
Rated Ampere Capacity	250-600 VOLTS, DIRECT CURRENT ONLY (Barriers between Poles)			
	Cat. No.	2-Pole Ind'p't Arm Inter. Trip 1-Pole Plain Overload 1-Pole Plain Underload	Cat. No.	2-Pole Rigid Arm 1-Pole Plain Overload 1-Pole Plain Underload
5	53931	\$73.75	53963	\$73.75
10	53933	73.75	53965	73.75
15	53935	73.75	53967	73.75
20	53937	73.75	53969	73.75
30	53939	73.75	53971	73.75
45	53941	73.75	53973	73.75
60	53943	73.75	53975	73.75
80	53945	73.75	53977	73.75
100	53947	95.00	53979	95.00
150	53949	95.00	53981	95.00
200	53951	95.00	53983	95.00
300	53953	163.50	53985	163.50
400	53955	163.50	53987	163.50
500	53957	163.50	53989	163.50
600	53959	197.00	53991	197.00
800	53961	278.00	53993	278.00

NOTE: For underload "Industrial" Type circuit breakers in capacities of 3 to 80 amperes see listing on Page 4 of Bulletin No. 520.

In ordering, specify catalog number and style of mounting. All the catalog numbers shown on this page cover **switchboard mounting breakers only**. Catalog numbers covering **front connected** breakers are the same as the ones listed, except that the first numeral of each catalog number is "6" instead of "5." For example Catalog No. 53700 is a 5 ampere, 250 volt, single pole, plain underload **back connected** breaker for **switchboard mounting**, and Catalog No. 63700 is a corresponding breaker, **front connected** for wall mounting. **Add 15% to printed list prices for front connections.

In ordering the circuit breakers listed on this page, be sure to specify the catalog number which corresponds to the mounting wanted, and style of mounting should be specified **as well** so as to eliminate any possibility of error.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS



500 ampere, 250 volt, D. C., double pole, rigid arm, combined overload and under-voltage, with equalizer contacts, for switchboard mounting

UNDER-VOLTAGE CIRCUIT BREAKERS

DESCRIPTION. Under-voltage circuit breakers function by opening automatically when the line voltage falls to a predetermined percentage of normal. The tripping mechanism is somewhat similar to that of the underload breaker except that a shunt instead of a series coil is used.

When line voltage is present and the breaker closed, the armature is held upward by the magnetism of the under-voltage coil, which is connected across the line. When the line voltage falls below the predetermined value mentioned below, the armature is released and the latter causes the breaker to open. The construction of these breakers is such that they cannot remain closed unless the line voltage is above the critical value.

The windings of the under-voltage coils are liberally proportioned as to current-carrying capacity, and they may consequently be left in circuit continuously without danger of overheating. The under-voltage coil is generally located to one side of one of the poles, but in some special cases, the entire under-voltage feature is incorporated in the pole housings.

TRIPPING POINT. D. C. under-voltage breakers are normally set to function when the line voltage falls to about 60% of normal and A. C. breakers to about 90%. If so requested, at the

time of ordering, however, we can set D. C. breakers to trip as high as 70% of line voltage.

NUMBER OF UNDER-VOLTAGE COILS. All single and double pole breakers have one under-voltage coil; all three pole breakers of 300 ampere capacity and over, and all four pole breakers have two under-voltage coils.

APPLICATION. Under-voltage tripped circuit breakers are used chiefly for the protection of motors where it is desirable to have some means which will cause disconnection when the supply voltage falls so as to eliminate the sudden heavy rush of current which would take place when, after a momentary interruption of current supply and before the attendant or operator has thought to open the switch, line potential is again applied. There are, of course, many other applications for these breakers, prominent among which is remote control. For this purpose a normally closed push button or other type of switch is connected in series with the under-voltage coil and located at any convenient point. The breaker can then be opened merely by operating the push button or switch. Another similar application is in connection with our reverse current and other types of relays. (Reverse current protection is covered on page 22.)

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

PLAIN UNDER-VOLTAGE CIRCUIT BREAKERS. Breakers of the plain under-voltage type, i.e., without overload actuation, can be supplied at the same prices and in the same combinations as listed below. Since there is no reduction in the price for the omission of overload actuation, the combined overload and under-voltage type is usually employed.

COMBINED OVERLOAD AND UNDER-VOLTAGE **BACK CONNECTED

*Rated Amperes Capacity	250 VOLTS AND UNDER, DIRECT OR ALTERNATING CURRENT									
	Cat. No.	1-Pole	Cat. No.	12-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
5	54000	\$43.50	54050	\$78.00	54100	\$78.00	54150	\$113.00	54200	\$193.00
10	54002	43.50	54052	78.00	54102	78.00	54152	113.00	54202	193.00
20	54004	43.50	54054	78.00	54104	78.00	54154	113.00	54204	193.00
30	54006	43.50	54056	78.00	54106	78.00	54156	113.00	54206	193.00
45	54008	43.50	54058	78.00	54108	78.00	54158	113.00	54208	193.00
60	54010	43.50	54060	78.00	54110	78.00	54160	113.00	54210	193.00
80	54012	43.50	54062	78.00	54112	78.00	54162	113.00	54212	193.00
100	54014	57.00	54064	103.50	54114	103.50	54164	147.00	54214	211.00
150	54016	57.00	54066	103.50	54116	103.50	54166	147.00	54216	211.00
200	54018	57.00	54068	103.50	54118	103.50	54168	147.00	54218	211.00
300	54020	91.50	54070	159.00	54120	159.00	54170	267.00	54220	329.00
400	54022	91.50	54072	159.00	54122	159.00	54172	267.00	54222	329.00
500	54024	91.50	54074	159.00	54124	159.00	54174	267.00	54224	329.00
600	54026	112.00	54076	217.00	54126	217.00	54176	307.00	54226	417.00
800	54028	142.00	54078	273.00	54128	273.00	54178	419.00	54228	532.00
1000	54030	185.00	54080	353.00	54130	353.00	54180	509.00	54230	723.00
1200	54032	190.00	54082	373.00	54132	373.00	54182	519.00	54232	743.00

*Rated Amperes Capacity	250-600 VOLTS, DIRECT OR ALTERNATING CURRENT (Barriers between Poles)									
	Cat. No.	1-Pole	Cat. No.	12-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
5	54250	\$50.00	54300	\$80.00	54350	\$80.00	54400	\$120.00	54450	\$180.00
10	54252	50.00	54302	80.00	54352	80.00	54402	120.00	54452	180.00
20	54254	50.00	54304	80.00	54354	80.00	54404	120.00	54454	180.00
30	54256	50.00	54306	80.00	54356	80.00	54406	120.00	54456	180.00
45	54258	50.00	54308	80.00	54358	80.00	54408	120.00	54458	180.00
60	54260	50.00	54310	80.00	54360	80.00	54410	120.00	54460	180.00
80	54262	50.00	54312	80.00	54362	80.00	54412	120.00	54462	180.00
100	54264	64.00	54314	114.00	54364	114.00	54414	162.00	54464	234.00
150	54266	64.00	54316	114.00	54366	114.00	54416	162.00	54466	234.00
200	54268	64.00	54318	114.00	54368	114.00	54418	162.00	54468	234.00
300	54270	98.00	54320	180.00	54370	180.00	54420	264.00	54470	396.00
400	54272	98.00	54322	180.00	54372	180.00	54422	264.00	54472	396.00
500	54274	98.00	54324	180.00	54374	180.00	54424	264.00	54474	396.00
600	54276	118.00	54326	238.00	54376	238.00	54426	352.00	54476	522.00
800	54278	148.00	54328	282.00	54378	282.00	54428	442.00	54478	678.00
1000	54280	191.00	54330	372.00	54380	372.00	54430	580.00	54480	891.00
1200	54282	196.00	54332	387.00	54382	387.00	54432	595.00	54482	911.00

* For capacities higher than 1200 Amperes, see pages 11 and 12.

† Two-pole, independent arm breakers without the "interlocked trip" feature can be supplied if desired. To obtain prices of such breakers add together the list prices of a single pole plain under-voltage breaker and a single pole overload and under-voltage breaker of the desired specifications. If potentials over 250 volts are involved add, in addition, \$4.00 for the resulting combination, for barriers between poles.

In ordering, specify catalog number, style of mounting, operating voltage, whether D. C. or A. C., and, if for A. C., frequency and number of phases and wires.

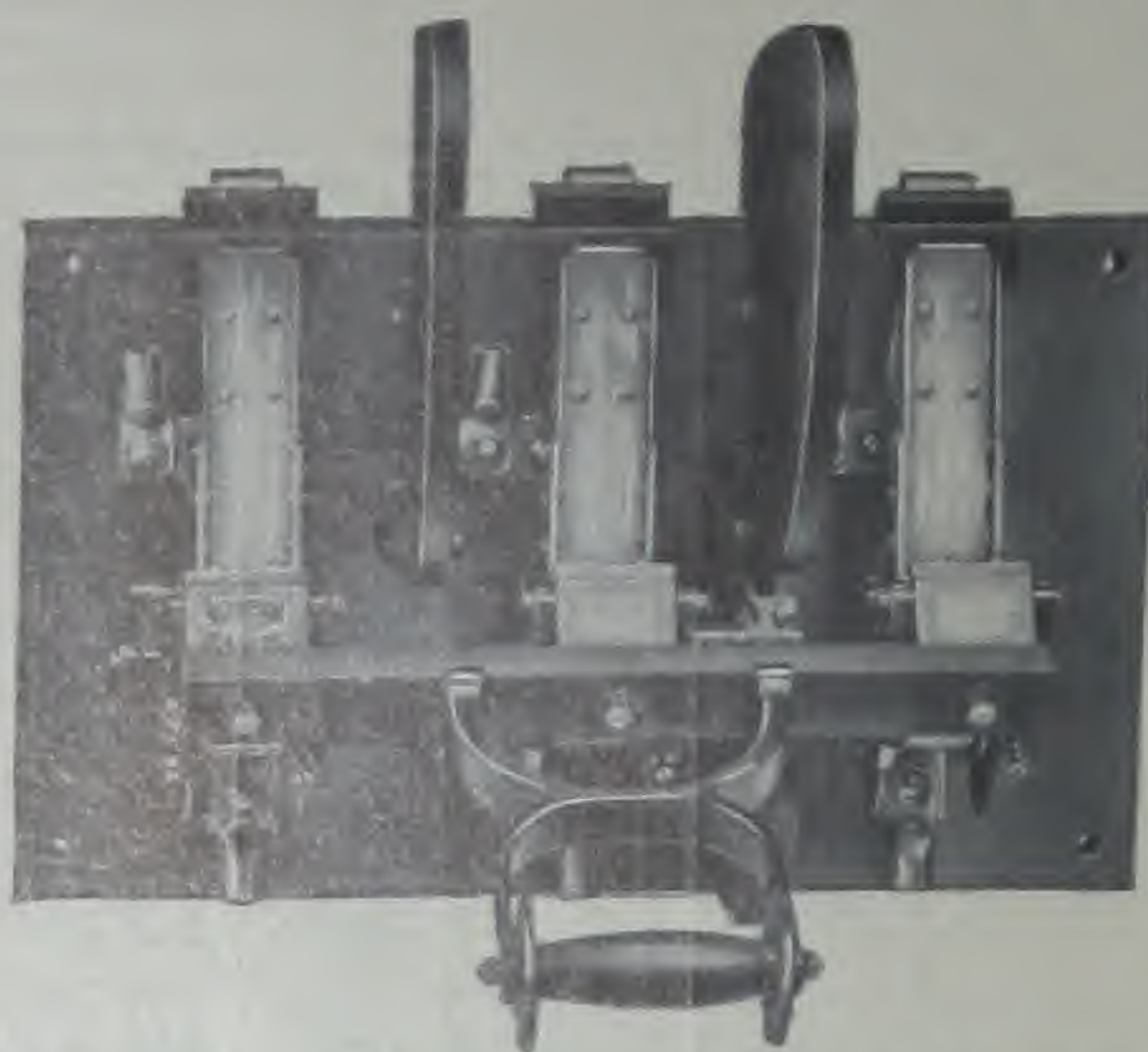
Note: Three pole breakers for 2 phase, 3 wire service, should have the middle pole about 1½ times the capacity of the outside poles. Price is usually the same as for a regular 3 pole breaker of same capacity as middle pole of breaker desired. Prices quoted on application.

All the catalog numbers shown on this page cover switchboard mounting breakers only. Catalog numbers covering front connected circuit breakers are the same as the ones listed, except that the first numeral of each catalog number is "6" instead of "5." For example, Catalog No. 64000 is a 5 ampere, 250 volt, single pole, under-voltage back connected breaker for switchboard mounting, and Catalog No. 64000 is a corresponding breaker, front connected for wall mounting. **Add 15% to printed list prices for front connections.

In ordering the circuit breakers listed on this page, be sure to specify the catalog number which corresponds to the mounting desired, and style of mounting should be specified as well so as to eliminate any possibility of error.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

SHUNT-TRIP CIRCUIT BREAKERS



200 ampere, 600 volt, 3 pole, rigid arm, combined overload and shunt-trip, with barriers and with circuit-opening auxiliary switch, front connections

DESCRIPTION. Shunt trip breakers consist usually of a standard overload breaker with a tripping attachment included, which permits the breaker to be opened from some remote point. The shunt trip feature consists of a shunt coil, which is connected across the line to an appropriate normally open switch. When the switch is closed the shunt coil is energized and the breaker is opened. The shunt coil windings are so proportioned that they will take the actuating current without undue heating for a short period of time but the coils are not intended to be left in circuit continuously and the switch used to control the circuit must be such as to open itself. If conditions are such that the operating switch is liable to stay in the closed position an auxiliary switch should be inserted in the circuit, which will open when the breaker opens. See listing of these switches on page 23.

RANGE OF TRIPPING VOLTAGE. Shunt trip coils are wound for a certain definite voltage, but they will operate at from 70% of normal to 125% of normal without injury.

NUMBER OF SHUNT TRIP COILS. One shunt trip coil is all that is necessary per breaker, regardless of the number of poles.

APPLICATION. This type of breaker is frequently used when it is desired to open a given circuit from a distance by means of light pilot wires and a switch.

It is suited particularly to such service as the protection of crane and elevator motors, whereby providing suitable limit switches the motion of the crane or car can be stopped when a predetermined limit of travel is reached, thus rendering it impossible to over-run the track, even if the operator fails to open his control switch in time. They are used also where the apparatus driven by motor makes it desirable to have emergency stop stations located at various points. Another wide use is in connection with reverse current relays, wherein the relay actuates the tripping circuit and opens the breaker upon reversal of current. See section covering reverse current relays. Undervoltage breakers may frequently be used instead of a shunt trip breaker to advantage, particularly where the undervoltage feature is desirable. In this arrangement the switch employed for tripping the circuit is of the normally closed type and operating it opens the undervoltage coil circuit, which trips the breaker. There are many applications, however, where it is undesirable to have the under-voltage feature and, on these where remote tripping is desired, the shunt trip type should be used.

ELECTRICAL INTERLOCK. Another application of the shunt trip breaker is in connection with what is termed "electrical interlock" protection. When it is desired to render it impossible to close one circuit breaker while another one is in the closed position, by incorporating shunt trip attachments on both breakers and including auxiliary switches in the shunt trip circuits, an arrangement can be obtained whereby the closing of breaker No. 2 will allow an auxiliary switch to close, which will close the shunt trip circuit on breaker No. 1. Both breakers can be open at the same time, but only one, however, can be closed at a time. This form of protection is recommended where two sources of current are available for distribution on one set of lines, as in the case of a building having available both a regular and an emergency supply.

PLAIN SHUNT TRIP BREAKERS. Breakers of plain shunt trip type, i.e., without overload actuation, can be supplied at the same prices and in the same combinations as listed for the overload shunt trip type. Since there is no reduction in price for the omission of the overload actuation, overload and shunt trip type is generally employed.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

COMBINED OVERLOAD AND SHUNT-TRIP
**BACK CONNECTED

*Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT OR ALTERNATING CURRENT									
	Cat. No.	1-Pole	Cat. No.	†2-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
5	54500	\$ 43.50	54550	\$ 78.00	54600	\$ 78.00	54650	\$113.00	54700	\$147.50
10	54502	43.50	54552	78.00	54602	78.00	54652	113.00	54702	147.50
20	54504	43.50	54554	78.00	54604	78.00	54654	113.00	54704	147.50
30	54506	43.50	54556	78.00	54606	78.00	54656	113.00	54706	147.50
45	54508	43.50	54558	78.00	54608	78.00	54658	113.00	54708	147.50
60	54510	43.50	54560	78.00	54610	78.00	54660	113.00	54710	147.50
80	54512	43.50	54562	78.00	54612	78.00	54662	113.00	54712	147.50
100	54514	57.00	54564	103.50	54614	103.50	54664	147.50	54714	191.50
150	54516	57.00	54566	103.50	54616	103.50	54666	147.50	54716	191.50
200	54518	57.00	54568	103.50	54618	103.50	54668	147.50	54718	191.50
300	54520	91.50	54570	169.00	54620	169.00	54670	241.00	54720	312.50
400	54522	91.50	54572	169.00	54622	169.00	54672	241.00	54722	312.50
500	54524	91.50	54574	169.00	54624	169.00	54674	241.00	54724	312.50
600	54526	112.00	54576	217.00	54626	217.00	54676	302.00	54726	403.00
800	54528	142.00	54578	270.50	54628	270.50	54678	393.00	54728	526.00
1000	54530	185.00	54580	365.00	54630	365.00	54680	530.00	54730	695.00
1200	54532	190.00	54582	375.00	54632	375.00	54682	545.00	54732	710.00

*Rated Ampere Capacity	250-600 VOLTS, DIRECT OR ALTERNATING CURRENT (Barriers between Poles)									
	Cat. No.	1-Pole	Cat. No.	†2-Pole Ind'p't Arm Int. Trip	Cat. No.	2-Pole Rigid Arm	Cat. No.	3-Pole Rigid Arm	Cat. No.	4-Pole Rigid Arm
5	54750	\$50.00	54800	\$89.00	54850	\$89.00	54900	\$129.00	54950	\$167.00
10	54752	50.00	54802	89.00	54852	89.00	54902	129.00	54952	167.00
20	54754	50.00	54804	89.00	54854	89.00	54904	129.00	54954	167.00
30	54756	50.00	54806	89.00	54856	89.00	54906	129.00	54956	167.00
45	54758	50.00	54808	89.00	54858	89.00	54908	129.00	54958	167.00
60	54760	50.00	54810	89.00	54860	89.00	54910	129.00	54960	167.00
80	54762	50.00	54812	89.00	54862	89.00	54912	129.00	54962	167.00
100	54764	64.00	54814	114.50	54864	114.50	54914	163.00	54964	211.00
150	54766	64.00	54816	114.50	54866	114.50	54916	163.00	54966	211.00
200	54768	64.00	54818	114.50	54868	114.50	54918	163.00	54968	211.00
300	54770	98.00	54820	180.50	54870	180.50	54920	256.50	54970	332.00
400	54772	98.00	54822	180.50	54872	180.50	54922	256.50	54972	332.00
500	54774	98.00	54824	180.50	54874	180.50	54924	256.50	54974	332.00
600	54776	118.50	54826	228.50	54876	228.50	54926	298.00	54976	398.00
800	54778	148.50	54828	282.00	54878	282.00	54928	408.00	54978	545.50
1000	54780	191.00	54830	375.00	54880	375.00	54930	544.00	54980	713.00
1200	54782	196.00	54832	385.00	54882	385.00	54932	559.00	54982	728.00

*For capacities higher than 1200 Amperes, see pages 11 and 12.
†Two-pole, independent arm breakers **without** the "interlocked trip" feature can be supplied if desired. To obtain prices of such breakers add together the list prices of a single pole plain overload breaker and a single pole overload and shunt-trip breaker of the desired specifications. If potentials over 250 volts are involved add, in addition, \$4.00 list to the resulting combination, for barriers between poles.

In ordering, specify catalog number, style of mounting, operating voltage, whether D. C. or A. C., and, if for A. C., frequency and number of phases and wires.

Note: Three pole breakers for 2 phase, 3 wire service should have the middle pole about 1½ times the capacity of the outside poles. Price is usually the same as for a regular 3 pole breaker of same capacity as **middle pole of breaker desired**. Prices on application.

All the catalog numbers shown on this page cover **switchboard mounting breakers only**. Catalog numbers covering **front connected** circuit breakers are the same as the ones listed, except that the first numeral of each catalog number is "6" instead of "5." For example, Catalog No. 54500 is a 5 ampere, 250 volt, single pole, shunt-trip, **back connected** breaker for switchboard mounting, and Catalog No. 64500 is a corresponding breaker, **front connected** for wall mounting. ****Add 15% to printed list prices for front connections.**

In ordering the circuit breakers listed on this page, be sure to specify the catalog number which corresponds to the mounting wanted, and style of mounting should be specified **as well**, so as to eliminate any possibility of error.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

NON-CLOSABLE ON OVERLOAD

(Free Handle)



The ROLLER-SMITH Company offers its Non-Closable on Overload (Free Handle) Breaker in connection with any of the Standard types listed in the other pages of this Bulletin. They may be had in any combination of current, voltage, style of trip, or number of poles, except the two-pole, independent arm, interlock trip.

The advantages of a Free Handle breaker for many applications are so well known as hardly to warrant a detailed listing of their uses.

Briefly, the ROLLER-SMITH Free Handle breaker differs from the regular breaker in the construction of the handle lever element. The standard R-S contact brush and overload coil, which have proved to be so dependable, are not altered and the electrical functioning of the Free Handle breakers is just as simple and dependable as in the Non-Free Handle type. To close the breaker, the handle is first raised and then pulled

down. To open the breaker, the handle is raised in the conventional way. There are no small trip buttons or knobs to be hunted for. The Free Handle parts are few in number, rugged in construction and their functions so simple as to be readily obvious.

The design of the ROLLER-SMITH Free Handle Breaker is such that it cannot be held closed against an overload, no matter how much pressure is applied to the handle. Substantial cast members preclude the springing of any of the Free Handle parts, which is possible if stampings are used.

Non-Closable on Overload attachments can be supplied at the following list prices in addition to the list prices of the selected circuit breakers:

LIST PRICES

Frame No.	Ampere Capacity	Current	Single Pole	2-Pole Rigid Arm	3-Pole Rigid Arm	4-Pole Rigid Arm
2	5- 80	A. C. or D. C.	\$ 4.00	\$ 10.00	\$ 15.00	\$ 20.00
3	100- 200	A. C. or D. C.	5.00	15.00	20.00	26.00
4	300- 500	A. C. or D. C.	8.00	20.00	30.00	40.00
4 1/2	600- 800	A. C. or D. C.	8.00	20.00	30.00	40.00
5	1000-1200	A. C. or D. C.	20.00	50.00	75.00	100.00
6	1500-2000	A. C. or D. C.	30.00	80.00	110.00	140.00
6 1/2	2500	A. C. or D. C.	40.00	100.00	140.00	180.00
6 3/4	3000	D. C.	60.00	120.00	210.00	240.00
6 3/4	3000-4000	A. C.	80.00	160.00	240.00	300.00
6 3/4	4000-6000	D. C.	80.00	160.00	240.00	300.00

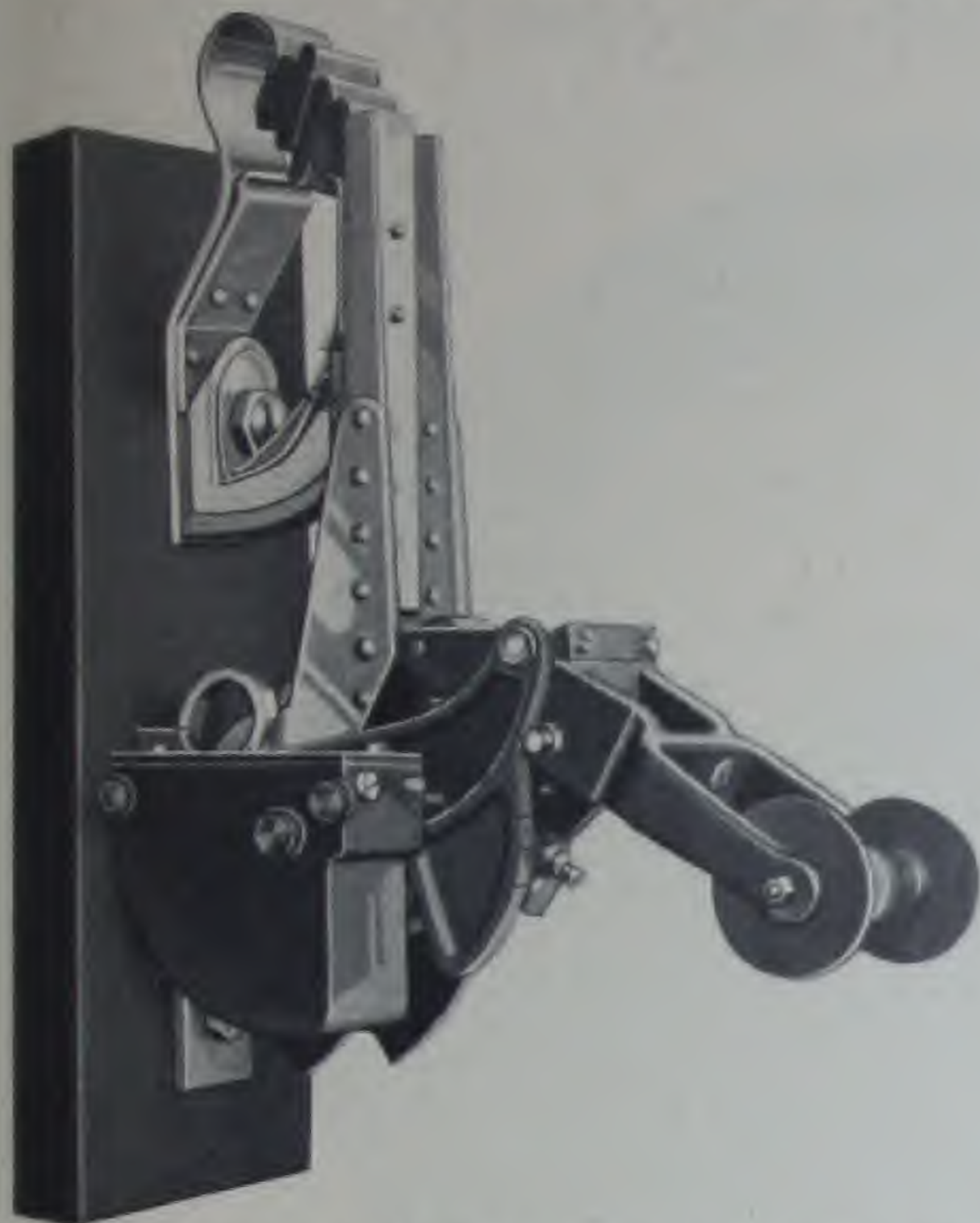
Prices for capacities over 4000 amperes A. C. and over 6000 amperes D. C. will be quoted on application.

DIRECTIONS FOR ORDERING: Give the full information asked for at the bottom of the page in this Bulletin on which is listed the circuit breaker selected and specify on your order "NON-CLOSABLE ON OVERLOAD."

For example, assume a 1000 ampere, 250 volt, direct current, single pole, plain overload circuit breaker. The list price of this breaker, Catalog number 53030, as shown on page 10 is \$155.00. Referring to the table above it will be seen that the extra list charge for the Free Handle feature for Frame 5 (1000-1200 amperes) is \$20.00 for single pole. The total list figure is, therefore, \$155.00 plus \$20.00 or \$175.00.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

DIRECT ACTING TIME LIMIT ATTACHMENTS



500 Ampere, Single Pole Circuit Breaker with Direct Acting Time Limit Attachment

An inverse Time Limit attachment may be had for applying directly to any ROLLER-SMITH Standard Type Circuit Breaker. Generally the attachment is placed on one side of the breaker housing and no special drilling of the panel is necessary. The ROLLER-SMITH direct acting time limit attachment permits the breaker to open almost instantly on heavy overloads and provides a delayed time action on lesser loads. For use in connection with motors, which are thrown directly on the line or for use in controlling groups of tungsten lamps and other similar applications where an initial inrush of current of short duration occurs, the time limit breaker is ideal.

DESCRIPTION

The R-S Time Limit consists of a dashpot of special design, which is placed so as to retard the movement of the overload armature of the breaker in the event of an overload taking place. The action does not depend on finely fitted discs, which are very susceptible to the presence of dirt or slight unevennesses.

After the breaker has been mounted in position, the cover of the dashpot may be removed and a small quantity of oil, which is furnished with the breaker, may be poured in the top. If at any time it should be desired to change the oil in the dashpot, the removal of two screws will permit the dashpot to be taken from the breaker and cleaned out without any complications.

The dashpot is usually placed on the side of a breaker, but where width limitations have to be considered, it can be placed underneath the breaker in many combinations wherein undervoltage or shunt trip features are not involved. On a three pole breaker with two time limit attachments one attachment is placed on the outer side of each outside pole. Side location is standard and underslung mounting should be the subject of correspondence.

LIST PRICES PER ATTACHMENT

Frame No.	Ampere Capacity	Current	List Price Each	Frame No.	Ampere Capacity	Current	List Price Each
2	5- 80	A. C. or D. C.	\$25.00	6	1500-2000	A. C. or D. C.	\$61.00
3	100- 200	A. C. or D. C.	31.00	6 1/2	2500-3000	A. C. or D. C.	71.00
4	300- 500	A. C. or D. C.	31.00	6 1/2	3000	D. C.	71.00
4 1/2	600- 800	A. C. or D. C.	46.00	6 3/4	3000-4000	A. C.	87.00
5	1000-1200	A. C. or D. C.	46.00	6 3/4	4000-6000	D. C.	87.00

Prices for capacities over 4000 amperes will be quoted on application.

DIRECTIONS FOR ORDERING: Give the full information asked for at the bottom of the page in this Bulletin, on which is listed the circuit breaker selected, and specify in addition "With (quantity) Direct Acting Time Limit Attachment(s)."

EXAMPLE: Assume a 1000 ampere, 250 volt, D. C., single pole, overload circuit breaker. The list price of this breaker, Cat. No. 53030, as shown on page 10 is \$155.00. Referring to the table above it will be seen that the extra list charge is \$46.00 for the time limit attachment for Frame 5 (1000-1200 amperes), only one attachment being required. The total list of the breaker with attachment is, therefore, \$201.00.

As a second example, assume that same breaker but with 2 poles, rigid arm, listed as Cat. No. 53098 on page 10. The list price of the breaker is \$335.00, to which should be added \$92.00 list for two time limit attachments (each listing at \$46.00 as given in the above table). The total list price of this breaker plus the two attachments would be \$427.00.

Single pole breakers require only one time limit attachment. Two, three and four pole breakers usually require two attachments.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

REVERSE CURRENT PROTECTION FOR DIRECT CURRENT CIRCUITS



Type SR Reverse Current Relay, 7 1/2-inch diameter

DESCRIPTION. ROLLER-SMITH reverse current equipment consists of an appropriate under-voltage or shunt-trip circuit breaker in conjunction with a Type SR reverse current relay, described in Bulletin No. 550. Reversal of line current causes the relay to open the breaker by opening the under-voltage coil circuit, or closing the shunt-trip coil circuit as the case may be.

RANGE OF ADJUSTMENT. The relays can be set to trip at any desired point between zero and 25% reverse current.

APPLICATION. Reverse current equipment is used generally for the protection of storage batteries. This application is then similar to underload circuit breakers, except that a much greater range of adjustment is afforded. Reverse current breakers are especially desirable on the larger size battery charging outfits, but are furnished for small ampere capacities as well.

Reverse current equipment is used also for the protection of two or more generators operating in parallel.

For prices and other details see Bulletin No. 550.

DIRECT CURRENT OVERLOAD, UNDERLOAD, OVER-VOLTAGE UNDER-VOLTAGE AND TIME LIMIT RELAYS

These also are described in Bulletin No. 550 and are for use with under-voltage and shunt-trip circuit breakers.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

COUNTER-BALANCED ARMATURE CIRCUIT BREAKERS

Counter-balanced armature circuit breakers can be supplied at an extra charge of 10% over the list price of the breaker selected, this covering circuit breakers up to and including 1200 amperes capacity. Prices on capacities over 1200 amperes will be furnished on application.

A. C.=D. C. CIRCUIT BREAKERS

Overload, Standard Type breakers with both A. C. and D. C. calibration can be supplied. This special feature can be supplied at an extra charge of 10% over the list price of the breaker selected.

AUXILIARY SWITCHES

The R-S auxiliary switch is a self-contained plunger type of switch, which can be mounted on the panel by drilling one hole. These switches are single pole and are supplied either normally open or normally closed. Connections are made to suitable terminals on the rear of the board, except in the case of front connected breakers, where connections are made on the face of the panel. If necessary, several can be operated from one breaker.

APPLICATION. They are used to operate auxiliary circuits, such as pilot lights, alarm bells, shunt trip coil circuits, etc. The tripping coil with shunt trip breakers cannot be left permanently in circuit without injury and the use of a auxiliary switch to open the circuit is recommended if there is any possibility of the closing switch of the circuit being permanently left on.

List prices are as follows:

Frame No. 2	(5 to 80 amperes)	\$11.00
" " 3	(100 " 200 ")	11.00
" " 4	(300 " 500 ")	12.00
" " 4½	(600 " 800 ")	12.00
" " 5	(1000 " 1200 ")	18.00
" " 6	(1500 " 2000 ")	18.00

Prices for capacities over 2,000 amperes will be quoted on application.

EQUALIZER CONTACTS

Where D. C. generators are used in parallel, it is necessary to open the equalizer circuits immediately after the main circuits are opened. To provide for this we supply equalizer contacts fixed to one of the poles of the circuit breaker. Equalizer contacts are plain switch contacts and have a current rating of 50% of that of the breaker. The moving member is insulated from the breaker by an appropriate cross-piece. For illustration, see page 16.

The list figures are as follows:

Frame No. 2	(5 to 80 amperes) per pole	\$12.75
" " 3	(100 " 200 ") " "	17.00
" " 4	(300 " 500 ") " "	29.50
" " 4½	(600 " ") " "	39.50
" " 4½	(800 " ") " "	52.50
" " 5	(1000 " ") " "	77.50
" " 5	(1200 " ") " "	80.00

Prices for capacities over 1,200 amperes will be quoted on application.

EXTRA LENGTH STUDS

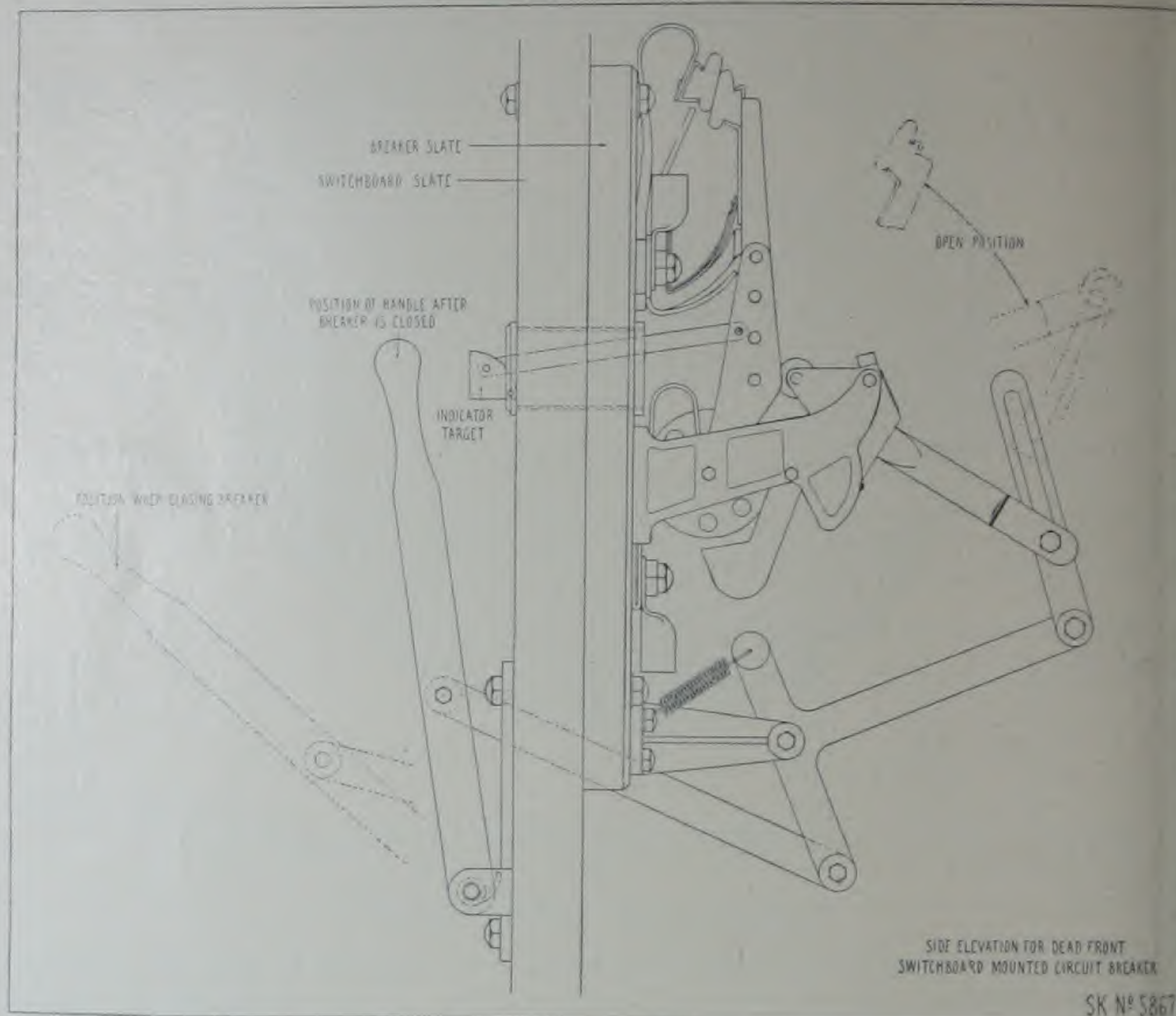
Where studs longer than the standard ones are needed we can supply such special studs at a nominal extra charge. Prices on application.

ENCLOSED CIRCUIT BREAKERS

We are prepared to supply entirely enclosed circuit breakers in certain capacities and combinations. See Bulletin No. 580.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

CIRCUIT BREAKERS FOR DEAD-FRONT SWITCHBOARDS



There is a tendency towards the use of dead-front switchboards and on such ROLLER-SMITH circuit breakers have some marked advantages and may be installed on such jobs without excessive difficulty or cost. The general scheme of applying the breaker to a dead-front board is to supply a front connected breaker the back of whose slate is bolted against the back of the dead-front board. Through a bell crank and levers the closing mechanism of the breaker is attached to a handle pivoted on the front of the board, this, in general, being similar to the conventional oil switch handle.

Breakers for dead front mounting can have any of the attachments which are furnished on standard switchboard type, such as undervoltage, time limit, free handle, etc. The design is arranged so that the speed at which the breaker opens is in no way retarded by the presence of the dead front mechanism. To close the breaker, the handle is pulled forward and released, after which it returns to a neutral position, being cushioned by a pneumatic cylinder. To open the breaker, the handle is pushed inward from the neutral position. A target appropriately located indicates whether the breaker is open or closed and the design of the target is such that its position may readily be observed from the side, as would be the case when the observer looked down along the length of a switchboard.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

On breakers above 1200 amperes the breakers have to be mounted by means of brackets a sufficient distance from the back of the switchboard to allow the passage of bus-bars or cables as breakers in these larger sizes cannot be made front connected.

The general plan is very flexible and can permit of a number of modifications, such as:

1. Pilot lamp instead of target may be used to indicate when the breaker is open or closed.

2. Breakers may be supported from frame located at any distance most convenient to customer from the back of the switchboard, that is, our linkage may be lengthened to suit a wide spacing between the breaker and the back of the board.

Such special features must be the subject of correspondence in each case so that proper data may be supplied and special prices, if any, arrived at.

The following **list** prices apply to the necessary "dead-front" attachments and should be added to the list price of the desired breakers:

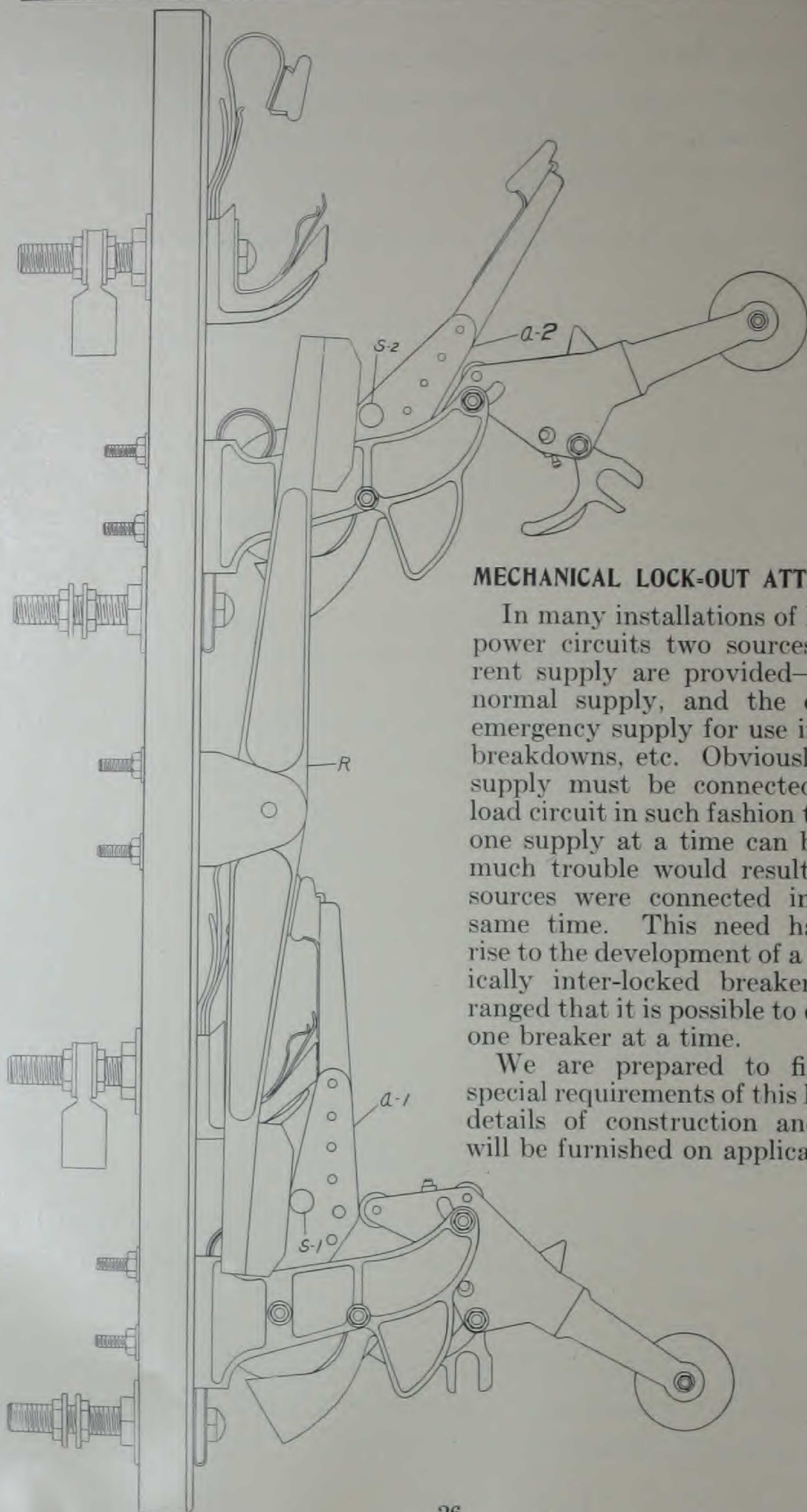
Frame No. 2	(	5 to	80	amperes)	.....	\$ 40.00
"	"	3	(	100 " 200	").....	50.00
"	"	4	(	300 " 500	").....	60.00
"	"	4½	(	600 " 800	").....	60.00
"	"	5	(	1000 " 1200	").....	75.00
"	"	6	(	1500 " 2000	").....	90.00
"	"	6½	(	2500 " 3000	").....	135.00
"	"	6¾	(	4000 " 6000	").....	135.00

Prices above 6000 amperes on application.

These prices apply to attachments for all breakers of the capacities listed and hold for either one, two, three or four pole breakers, all styles of trips.

In ordering, give the specifications of the desired breakers and add "with dead-front attachments." Should there be any question of detail attach a sketch to order showing layout desired.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

**MECHANICAL LOCK-OUT ATTACHMENT**

In many installations of light and power circuits two sources of current supply are provided—one the normal supply, and the other an emergency supply for use in case of breakdowns, etc. Obviously a dual supply must be connected to the load circuit in such fashion that only one supply at a time can be on, as much trouble would result if both sources were connected in at the same time. This need has given rise to the development of a mechanically inter-locked breaker so arranged that it is possible to close but one breaker at a time.

We are prepared to figure on special requirements of this kind and details of construction and prices will be furnished on application.

ROLLER-SMITH "STANDARD" TYPE CIRCUIT BREAKERS

NUMBER OF POLES TO USE

ON TWO WIRE CIRCUITS: A single pole, plain overload breaker gives protection and will save the fuses, but a fused knife switch must then also be employed. A double pole circuit breaker gives full automatic protection and switches can frequently be dispensed with. The independent arm type is usually to be preferred, as one pole can be closed at a time, and should an overload or short circuit exist, the pole first closed will open immediately after the other pole is closed. A rigid arm breaker may, however, be used, if so desired, in which case a switch is necessary also.

ON THREE WIRE CIRCUITS: On any three wire, A. C. or D. C. circuit a rigid arm, three pole breaker is generally used, but a two pole, rigid arm device may be used under certain conditions.

ON TWO PHASE, FOUR WIRE CIRCUITS: A four pole, rigid arm breaker is usually desirable, but frequently a two pole, rigid arm breaker is satisfactory if so connected as to effectively open one wire of each phase.

BREAKER CAPACITY TABLE

The following table shows the ampere capacity of breakers to be used for the protection of motors. Necessarily, average and not extreme values of motor efficiency had to be selected, but in general the table will be found conservative.

H. P.	D. C.			Single Phase A. C.		Two Phase—4 Wire A. C.			Three Phase—3 Wire A. C.		
	Voltage			Voltage		Voltage			Voltage		
	110	220	500	110	220	110	220	440	110	220	440
1	10	5	3	15	10	10	5	3	10	5	3
2	30	10	5	30	15	15	10	5	15	10	5
3	30	15	10	45	30	30	15	5	30	15	10
5	45	30	10	60	30	30	15	10	45	20	10
7.5	60	30	20	80	45	45	30	10	45	30	20
10	80	45	30	100	60	60	30	20	60	30	20
15	150	60	30	150	80	80	45	20	80	45	30
20	150	80	45	200	100	100	60	30	100	60	30
25	200	100	45	200	100	150	60	45	150	80	45
30	300	150	60	300	150	150	80	45	150	80	45
50	400	200	80	500	300	300	150	80	300	150	80
75	600	300	150	600	400	400	200	100	400	200	100
100	800	400	200	800	500	500	300	150	500	300	150

Data for two phase, three wire motors furnished on application.

ROLLER-SMITH Products comprise complete lines of Electrical Instruments, Relays and Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Representatives

SALES OFFICES

BOSTON	101 Milk Street	NEW ORLEANS	Masonic Temple
BUFFALO	Ellicott Square Building	OMAHA	W. O. W. Building
CHARLOTTE	Latonia Building	PHILADELPHIA	Otis Building
CHICAGO	Monadnock Building	PITTSBURGH	Westinghouse Bldg.
CLEVELAND	1988 E. 66th Street	ST. LOUIS	Railway Exchange Bldg.
DETROIT	General Motors Bldg.	ST. PAUL	Pioneer Building
HOUSTON	1006 Washington Avenue	SAN FRANCISCO	589 Howard Street
LOS ANGELES	443½ E. Third Street	SEATTLE	Polson Building
MONTREAL	Power Building	TORONTO	183 George Street
NEW HAVEN	152 Temple Street	TULSA	217 Archer Street
NEW YORK	233 Broadway	WASHINGTON	Evening Star Bldg.

A B R O A D

THRALL ELECTRIC COMPANY	Box 2049, Havana, Cuba
DUVAL TRADING CO.	Kembla Bldgs., Sydney, Australia
ASHIDA ENGINEERING CO.	Daini, Osaka, Japan



BULLETIN No. 580
April, 1929
(Superseding issue
dated December, 1927)



Enclosed Circuit Breakers

Types ESF, ES and EI



Type ESF (Free-Handle) Circuit Breaker
with cover in place

ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

*Representatives in
Australia, Cuba, Japan and Philippine Islands*

ROLLER-SMITH

Enclosed Circuit Breakers

Type ESF (Free-Handle) Type ES

Capacities 5 to 800 amperes.
For potentials up to 600 volts.
Direct or alternating current.
One, two, three and four pole.
Overload, under-voltage and combinations.
Instantaneous and time-limit trip.

Type EI

Capacities 5 to 100 amperes.
For potentials up to 250 volts.
Direct or alternating current.
One, two, three and four pole.
Overload, under-voltage and combinations.
Instantaneous trip.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ESF (Free-Handle)

Type ES — Type EI

AN enclosed circuit breaker is not merely "a breaker in a box"—as made by Roller-Smith. It is a combination of a specially designed breaker enclosed in a specially designed box, each designed and built to go with the other. Where enclosed breakers are involved there are many factors that are not present in the conventional "open" type of breaker. It must be possible—and convenient—to install the box first, if desired, and the breaker later. The box should have the conduit and mounting details so worked out as to enable quick and inexpensive mounting and pulling in of cables. The installing and connecting of the breaker should be made easy. The box should be so designed as to provide all safeguards against damage due to the "explosion" and liberation of gases that take place when a breaker opens under a heavy load. The layout should be such that changing a breaker can be easily accomplished. The complete struc-

ture must be rugged and sturdy and able to withstand all kinds of neglect and rough treatment and, finally, pleasing appearance and moderate cost must, of necessity, be important factors.

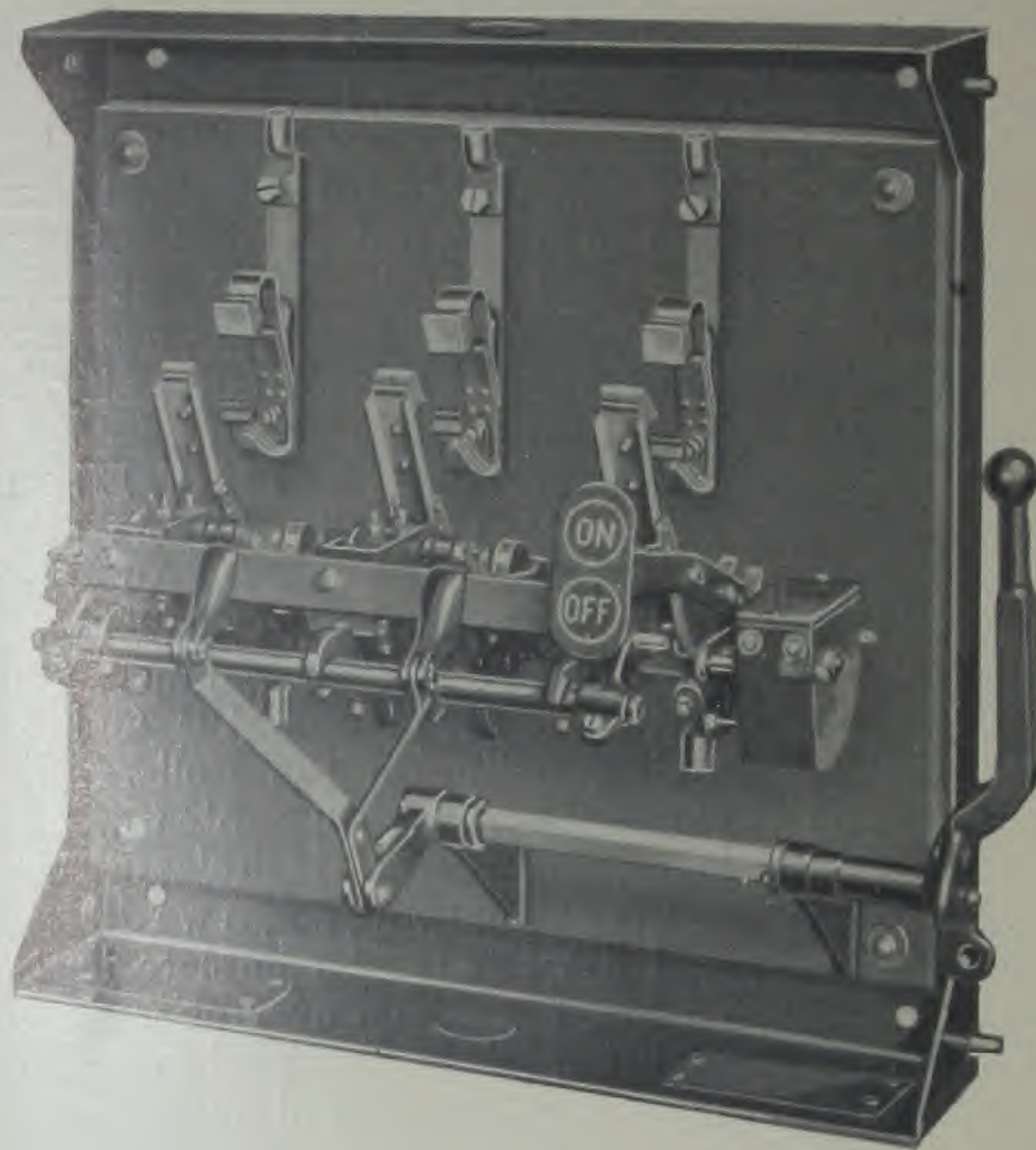
Roller-Smith Types ESF, ES and EI enclosed circuit breakers meet *all* these requirements. An experience of over thirty years in the manufacture of electrical measuring and protective apparatus and the high standing of the Roller-Smith Company are a guarantee of high class apparatus and high class service.

In the following pages we describe and list the most complete line of enclosed breakers ever offered. In addition we are prepared to and will be glad to design and quote on special breakers to meet special needs. There is a Roller-Smith office and a circuit breaker sales engineer in every important city in the United States and Canada, with excellent representation in many Countries in all parts of the World.

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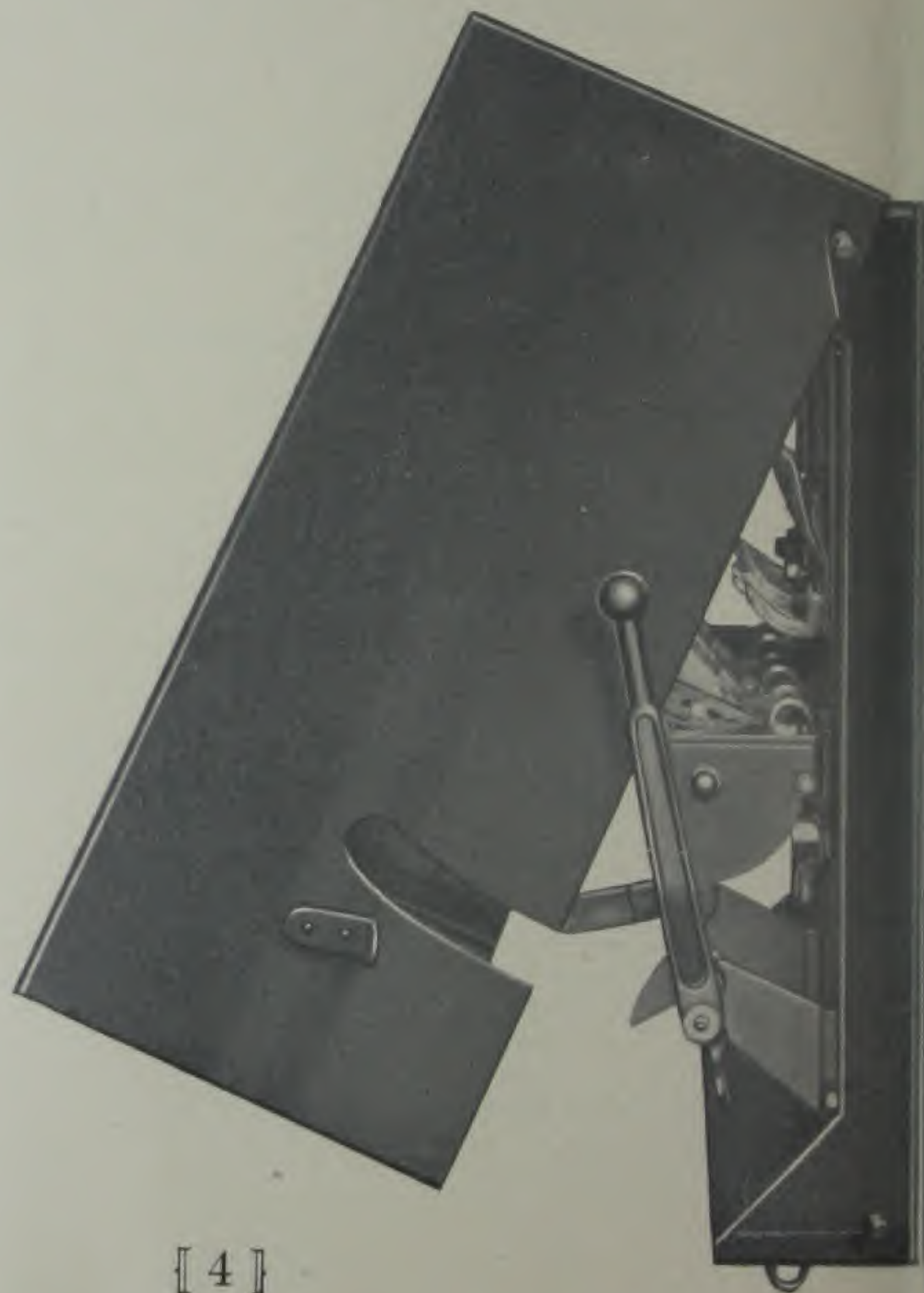
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ROLLER-SMITH ENCLOSED CIRCUIT BREAKER



Type ESF (Free
Handle) Circuit
Breaker with cover
removed; 80 am-
pere, 250 volt, three
pole, overload, time
limit.

Type ESF (Free
Handle) Circuit
Breaker, side view,
showing simple
method of taking
cover off or putting
it on.



ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ESF (Free-Handle)

ROLLER-SMITH Type ESF (Enclosed Standard Type, Free-handle) circuit breakers are recommended for all applications where an enclosed breaker of the non-closable-on-overload (free handle) style is wanted.

The breakers themselves are the well-known Standard Type and are described in detail in Bulletin No. 530, which will gladly be supplied on request. A few modifications have been made to adapt the breakers to enclosed service. The terminals are above and below and directly in line with the poles. The operating handle is located on the right and outside of the box. An "On" and "Off" target on the front indicates whether the breaker is closed or open. The slate bases on which the breakers are mounted are larger than usual so as to provide plenty of space inside the box for the cables. Special precautions have been taken to provide good insulation and a sturdy, reliable, fool-proof piece of protective apparatus.

Particular attention is called to the new and very novel box layout. Boxes are heavy gauge sheet steel, enameled a handsome maroon color. They are strong and rigid and built to withstand the tremendous pressures that are generated when a breaker opens under a heavy overload or a "short." Boxes are of the two-piece style consisting of a rear section and a cover. The rear sec-

tion, which carries the breaker, is mounted against the wall or column or on iron framework, as may be desired, and is fastened in place with screws, which are inserted from the front. Knock-out holes are provided at top and bottom and conduit connections may easily be made. The cables are then pulled in, connections made and the cover set in place. The setting in place of the cover consists, merely, in dropping the top part on the two pins on the upper part of the base section and then pushing the cover in. It locks firmly in place by means of spring mounted hasps at the bottom. Padlocks may be inserted in the hasp if the box is to be locked. To remove the cover simply depress the hasps, pull the cover outward and lift it off. The cover cannot be set in place or removed unless the breaker is in the open position. A decalcomania label on the front gives the simple instructions for operating the breaker "up, then down, to close; up to open."

The breaker itself may be installed or removed without disturbing the rear box section and conduits, which is a great advantage on new jobs when the rear box section is to be installed first and the breaker later on. The breaker, mounted on its slate base, is merely set in place and attached to the rear box section with four slotted, hex-head bolts.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKER

Type ESF (Free-Handle)

SINGLE POLE

*800 AMPERES AND UNDER

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	Overload and Undervoltage Time Limit
5	58000	\$95.00	58016	\$118.00	58032	\$113.00	58048	\$136.00
10	58001	95.00	58017	118.00	58033	113.00	58049	136.00
15	58002	95.00	58018	118.00	58034	113.00	58050	136.00
20	58003	95.00	58019	118.00	58035	113.00	58051	136.00
30	58004	95.00	58020	118.00	58036	113.00	58052	136.00
45	58005	95.00	58021	118.00	58037	113.00	58053	136.00
60	58006	95.00	58022	118.00	58038	113.00	58054	136.00
80	58007	95.00	58023	118.00	58039	113.00	58055	136.00
100	58008	114.00	58024	140.00	58040	137.00	58056	163.00
150	58009	114.00	58025	140.00	58041	137.00	58057	163.00
200	58010	114.00	58026	140.00	58042	137.00	58058	163.00
300	58011	165.00	58027	196.00	58043	198.00	58059	229.00
400	58012	165.00	58028	196.00	58044	198.00	58060	229.00
500	58013	165.00	58029	196.00	58045	198.00	58061	229.00
600	58014	184.00	58030	220.00	58046	218.00	58062	254.00
800	58015	211.00	58031	247.00	58047	248.00	58063	284.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	Overload and Undervoltage Time Limit
5	58080	\$95.00	58096	\$118.00	58112	\$120.00	58128	\$143.00
10	58081	95.00	58097	118.00	58113	120.00	58129	143.00
15	58082	95.00	58098	118.00	58114	120.00	58130	143.00
20	58083	95.00	58099	118.00	58115	120.00	58131	143.00
30	58084	95.00	58100	118.00	58116	120.00	58132	143.00
45	58085	95.00	58101	118.00	58117	120.00	58133	143.00
60	58086	95.00	58102	118.00	58118	120.00	58134	143.00
80	58087	95.00	58103	118.00	58119	120.00	58135	143.00
100	58088	114.00	58104	140.00	58120	144.00	58136	169.00
150	58089	114.00	58105	140.00	58121	144.00	58137	169.00
200	58090	114.00	58106	140.00	58122	144.00	58138	169.00
300	58091	165.00	58107	196.00	58123	207.00	58139	237.00
400	58092	165.00	58108	196.00	58124	207.00	58140	237.00
500	58093	165.00	58109	196.00	58125	207.00	58141	237.00
600	58094	184.00	58110	220.00	58126	226.00	58142	260.00
800	58095	211.00	58111	247.00	58127	254.00	58143	290.00

*Prices on capacities over 800 amperes quoted on application.

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ESF (Free-Handle)

DOUBLE POLE, DOUBLE COIL, RIGID ARM

*800 AMPERES AND UNDER

250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT								
Rated Ampere Capacity	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	58200	\$139.00	58216	\$163.00	58232	\$160.00	58248	\$184.00
10	58201	139.00	58217	163.00	58233	160.00	58249	184.00
15	58202	139.00	58218	163.00	58234	160.00	58250	184.00
20	58203	139.00	58219	163.00	58235	160.00	58251	184.00
30	58204	139.00	58220	163.00	58236	160.00	58252	184.00
45	58205	139.00	58221	163.00	58237	160.00	58253	184.00
60	58206	139.00	58222	163.00	58238	160.00	58254	184.00
80	58207	139.00	58223	163.00	58239	160.00	58255	184.00
100	58208	171.00	58224	197.00	58240	199.00	58256	225.00
150	58209	171.00	58225	197.00	58241	199.00	58257	225.00
200	58210	171.00	58226	197.00	58242	199.00	58258	225.00
300	58211	258.00	58227	289.00	58243	297.00	58259	328.00
400	58212	258.00	58228	289.00	58244	297.00	58260	328.00
500	58213	258.00	58229	289.00	58245	297.00	58261	328.00
600	58214	287.00	58230	325.00	58246	345.00	58262	381.00
800	58215	350.00	58231	386.00	58247	399.00	58263	435.00

250-600 VOLTS, DIRECT AND ALTERNATING CURRENT (BARRIERS BETWEEN POLES)								
Rated Ampere Capacity	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	58280	\$143.00	58296	\$167.00	58312	\$171.00	58328	\$195.00
10	58281	143.00	58297	167.00	58313	171.00	58329	195.00
15	58282	143.00	58298	167.00	58314	171.00	58330	195.00
20	58283	143.00	58299	167.00	58315	171.00	58331	195.00
30	58284	143.00	58300	167.00	58316	171.00	58332	195.00
45	58285	143.00	58301	167.00	58317	171.00	58333	195.00
60	58286	143.00	58302	167.00	58318	171.00	58334	195.00
80	58287	143.00	58303	167.00	58319	171.00	58335	195.00
100	58288	175.00	58304	201.00	58320	210.00	58336	236.00
150	58289	175.00	58305	201.00	58321	210.00	58337	236.00
200	58290	175.00	58306	201.00	58322	210.00	58338	236.00
300	58291	262.00	58307	293.00	58323	308.00	58339	339.00
400	58292	262.00	58308	293.00	58324	308.00	58340	339.00
500	58293	262.00	58309	293.00	58325	308.00	58341	339.00
600	58294	291.00	58310	329.00	58326	355.00	58342	391.00
800	58295	354.00	58311	390.00	58327	409.00	58343	445.00

*Prices on capacities over 800 amperes quoted on application.

†On two pole time limit breakers, one pole has time limit and the other pole has none, but the overload armature is heavily weighted so that an overload on *this* pole will not trip the breaker unless it assumes short circuit proportions. If *both* poles are wanted with time limit add the following list prices to the above figures covering "Plain overload, time limit" or "Overload and undervoltage, time limit" breakers:

5 to 80 amperes	\$23.50
100 to 200 "	26.00
300 to 500 "	31.00
600 to 800 "	36.00

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKER

Type ESF (Free-Handle)
THREE POLE, THREE COIL, RIGID ARM
***800 AMPERES AND UNDER**

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervolt Time Lim
5	58400	\$175.00	58416	\$222.00	58432	\$199.00	58448	\$246.00
10	58401	175.00	58417	222.00	58433	199.00	58449	246.00
15	58402	175.00	58418	222.00	58434	199.00	58450	246.00
20	58403	175.00	58419	222.00	58435	199.00	58451	246.00
30	58404	175.00	58420	222.00	58436	199.00	58452	246.00
45	58405	175.00	58421	222.00	58437	199.00	58453	246.00
60	58406	175.00	58422	222.00	58438	199.00	58454	246.00
80	58407	175.00	58423	222.00	58439	199.00	58455	246.00
100	58408	227.00	58424	279.00	58440	259.00	58456	311.00
150	58409	227.00	58425	279.00	58441	259.00	58457	311.00
200	58410	227.00	58426	279.00	58442	259.00	58458	311.00
300	58411	338.00	58427	400.00	58443	411.00	58459	451.00
400	58412	338.00	58428	400.00	58444	411.00	58460	451.00
500	58413	338.00	58429	400.00	58445	411.00	58461	451.00
600	58414	394.00	58430	466.00	58446	465.00	58462	537.00
800	58415	476.00	58431	548.00	58447	562.00	58463	634.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT AND ALTERNATING CURRENT (BARRIERS BETWEEN POLES)							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervolt Time Lim
5	58480	\$183.00	58496	\$230.00	58512	\$215.00	58528	\$262.00
10	58481	183.00	58497	230.00	58513	215.00	58529	262.00
15	58482	183.00	58498	230.00	58514	215.00	58530	262.00
20	58483	183.00	58499	230.00	58515	215.00	58531	262.00
30	58484	183.00	58500	230.00	58516	215.00	58532	262.00
45	58485	183.00	58501	230.00	58517	215.00	58533	262.00
60	58486	183.00	58502	230.00	58518	215.00	58534	262.00
80	58487	183.00	58503	230.00	58519	215.00	58535	262.00
100	58488	235.00	58504	287.00	58520	275.00	58536	327.00
150	58489	235.00	58505	287.00	58521	275.00	58537	327.00
200	58490	235.00	58506	287.00	58522	275.00	58538	327.00
300	58491	352.00	58507	408.00	58523	433.00	58539	473.00
400	58492	352.00	58508	408.00	58524	433.00	58540	473.00
500	58493	352.00	58509	408.00	58525	433.00	58541	473.00
600	58494	400.00	58510	474.00	58526	478.00	58542	550.00
800	58495	490.00	58511	556.00	58527	584.00	58543	656.00

*Prices on capacities over 800 amperes quoted on application.

†On three pole time limit breakers, two poles have time limits and the other (the center one) has no time limit but the overload armature is heavily weighted so that an overload on this pole will not trip the breaker unless it assumes short circuit proportions.

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ESF (Free-Handle) FOUR POLE, FOUR COIL, RIGID ARM *800 AMPERES AND UNDER

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	58600	\$222.00	58616	\$269.00	58632	\$265.00	58648	\$312.00
10	58601	222.00	58617	269.00	58633	265.00	58649	312.00
15	58602	222.00	58618	269.00	58634	265.00	58650	312.00
20	58603	222.00	58619	269.00	58635	265.00	58651	312.00
30	58604	222.00	58620	269.00	58636	265.00	58652	312.00
45	58605	222.00	58621	269.00	58637	265.00	58653	312.00
60	58606	222.00	58622	269.00	58638	265.00	58654	312.00
80	58607	222.00	58623	269.00	58639	265.00	58655	312.00
100	58608	277.00	58624	329.00	58640	332.00	58656	384.00
150	58609	277.00	58625	329.00	58641	332.00	58657	384.00
200	58610	277.00	58626	329.00	58642	332.00	58658	384.00
300	58611	432.00	58627	504.00	58643	511.00	58659	583.00
400	58612	432.00	58628	504.00	58644	511.00	58660	583.00
500	58613	432.00	58629	504.00	58645	511.00	58661	583.00
600	58614	516.00	58630	588.00	58646	589.00	58662	661.00
800	58615	626.00	58631	698.00	58647	724.00	58663	796.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT AND ALTERNATING CURRENT (BARRIERS BETWEEN POLES)							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	58680	\$234.00	58696	\$281.00	58712	\$291.00	58728	\$338.00
10	58681	234.00	58697	281.00	58713	291.00	58729	338.00
15	58682	234.00	58698	281.00	58714	291.00	58730	338.00
20	58683	234.00	58699	281.00	58715	291.00	58731	338.00
30	58684	234.00	58700	281.00	58716	291.00	58732	338.00
45	58685	234.00	58701	281.00	58717	291.00	58733	338.00
60	58686	234.00	58702	281.00	58718	291.00	58734	338.00
80	58687	234.00	58703	281.00	58719	291.00	58735	338.00
100	58688	293.00	58704	340.00	58720	359.00	58736	411.00
150	58689	293.00	58705	340.00	58721	359.00	58737	411.00
200	58690	293.00	58706	340.00	58722	359.00	58738	411.00
300	58691	444.00	58707	506.00	58723	536.00	58739	598.00
400	58692	444.00	58708	506.00	58724	536.00	58740	598.00
500	58693	444.00	58709	506.00	58725	536.00	58741	598.00
600	58694	528.00	58710	600.00	58726	612.00	58742	584.00
800	58695	538.00	58711	710.00	58727	750.00	58743	822.00

*Prices on capacities over 800 amperes quoted on application.

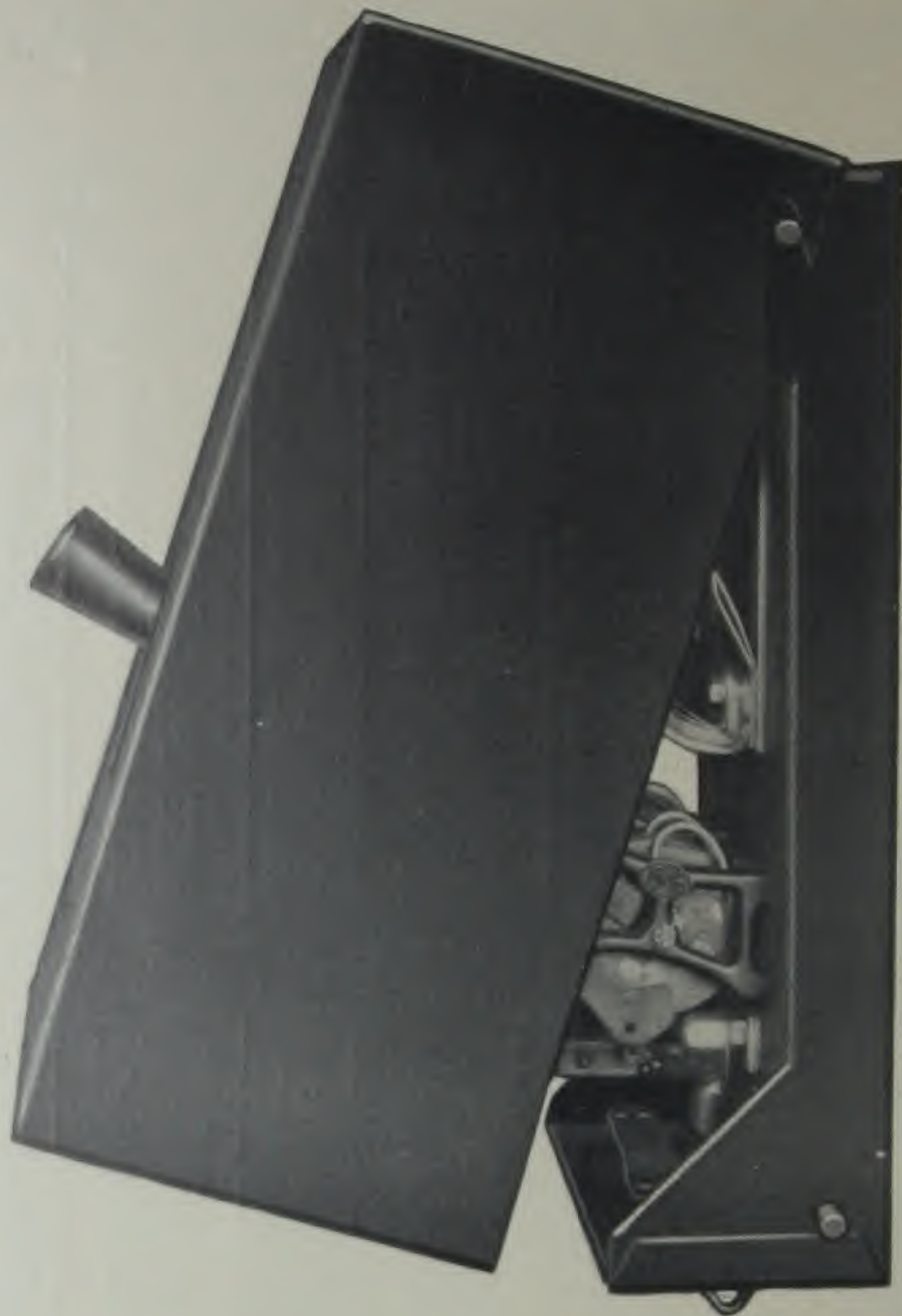
†On four pole time limit breakers, two poles have time limits and the other two (the center ones) have none, but the overload armatures are heavily weighted so that an overload on *these* two poles will not trip the breaker unless it assumes short circuit proportions.

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS



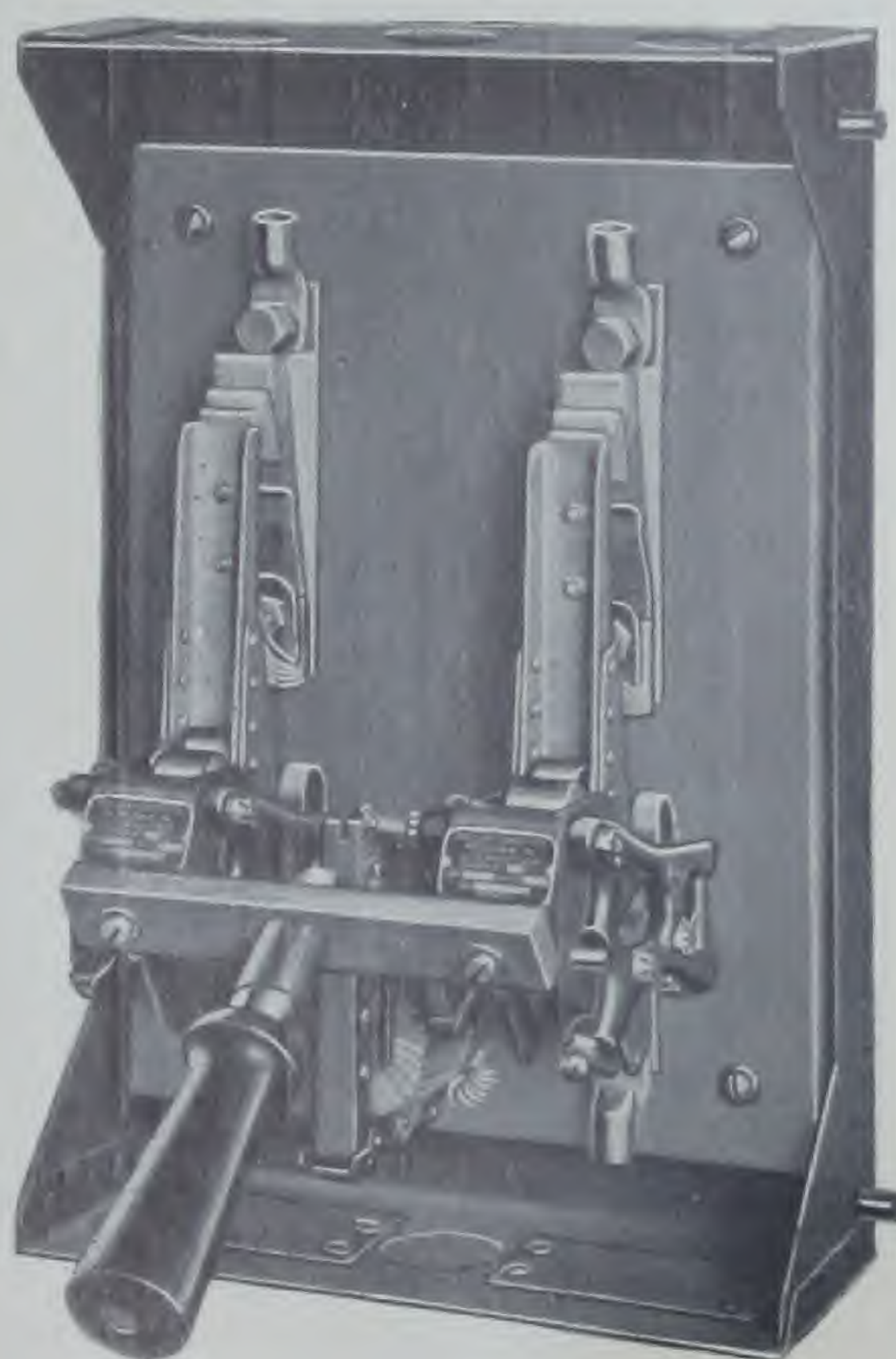
Type ES Circuit Breaker, side view, showing simple method of taking cover off or putting it on.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS



Type ES Circuit Breaker
with cover in place.

Type ES Circuit Breaker
with cover removed; 60
ampere, 250 volt, double
pole, rigid arm, com-
bined overload and un-
dervoltage.



ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ES

SINGLE POLE

Type ES (Enclosed Standard) circuit breakers differ from the Type ESF (described in the preceding pages) in the following essential respects:

1. They are *not* of the free handle (non-closable-on-overload) styles, although Type ES breakers can be supplied with free handle attachments at an extra charge as indicated in the listing.
2. The handle instead of being located on the right and outside of the box (as in the Type ESF) projects directly through a slot (or slots) in the front of the cover.

Outside of these two details Type ES breakers have all the features of the Type ESF and will find favor in those cases where the lower price of the Type ES is a consideration.

As, in the case of Type ESF breakers, the cover of the Type ES cannot be set in place or removed unless the breaker is in the open position.

Type ES breakers are available in the same styles and combinations as hold for the Type ESF.

*800 AMPERES AND UNDER

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	Overload and Undervoltage Time Limit
5	58800	\$66.00	58816	\$90.00	58832	\$84.00	58848	\$108.00
10	58801	66.00	58817	90.00	58833	84.00	58849	108.00
15	58802	66.00	58818	90.00	58834	84.00	58850	108.00
20	58803	66.00	58819	90.00	58835	84.00	58851	108.00
30	58804	66.00	58820	90.00	58836	84.00	58852	108.00
45	58805	66.00	58821	90.00	58837	84.00	58853	108.00
60	58806	66.00	58822	90.00	58838	84.00	58854	108.00
80	58807	66.00	58823	90.00	58839	84.00	58855	108.00
100	58808	82.00	58824	108.00	58840	105.00	58856	131.00
150	58809	82.00	58825	108.00	58841	105.00	58857	131.00
200	58810	82.00	58826	108.00	58842	105.00	58858	131.00
300	58811	126.00	58827	157.00	58843	159.00	58859	190.00
400	58812	126.00	58828	157.00	58844	159.00	58860	190.00
500	58813	126.00	58829	157.00	58845	159.00	58861	190.00
600	58814	145.00	58830	181.00	58846	179.00	58862	215.00
800	58815	172.00	58831	208.00	58847	209.00	58863	245.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	Overload and Undervoltage Time Limit
5	58880	\$66.00	58896	\$90.00	58912	\$91.00	58928	\$115.00
10	58881	66.00	58897	90.00	58913	91.00	58929	115.00
15	58882	66.00	58898	90.00	58914	91.00	58930	115.00
20	58883	66.00	58899	90.00	58915	91.00	58931	115.00
30	58884	66.00	58900	90.00	58916	91.00	58932	115.00
45	58885	66.00	58901	90.00	58917	91.00	58933	115.00
60	58886	66.00	58902	90.00	58918	91.00	58934	115.00
80	58887	66.00	58903	90.00	58919	91.00	58935	115.00
100	58888	82.00	58904	108.00	58920	112.00	58936	138.00
150	58889	82.00	58905	108.00	58921	112.00	58937	138.00
200	58890	82.00	58906	108.00	58922	112.00	58938	138.00
300	58891	126.00	58907	157.00	58923	166.00	58939	197.00
400	58892	126.00	58908	157.00	58924	166.00	58940	197.00
500	58893	126.00	58909	157.00	58925	166.00	58941	197.00
600	58894	145.00	58910	181.00	58926	186.00	58942	222.00
800	58895	172.00	58911	208.00	58927	216.00	58943	252.00

*Prices on capacities over 800 amperes quoted on application.

For free handle attachments and targets add the following list prices to the above figures:

5 to 80 amperes	\$8.50
100 to 200 "	9.50
300 to 500 "	12.50
600 to 800 "	12.50

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ES

DOUBLE POLE, DOUBLE COIL, INDEPENDENT ARM, INTERLOCKED TRIP

*800 AMPERES AND UNDER

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	59000	\$104.00	59016	\$128.00	59032	\$127.00	59048	\$151.00
10	59001	104.00	59017	128.00	59033	127.00	59049	151.00
15	59002	104.00	59018	128.00	59034	127.00	59050	151.00
20	59003	104.00	59019	128.00	59035	127.00	59051	151.00
30	59004	104.00	59020	128.00	59036	127.00	59052	151.00
45	59005	104.00	59021	128.00	59037	127.00	59053	151.00
60	59006	104.00	59022	128.00	59038	127.00	59054	151.00
80	59007	104.00	59023	128.00	59039	127.00	59055	151.00
100	59008	131.00	59024	157.00	59040	159.00	59056	185.00
150	59009	131.00	59025	157.00	59041	159.00	59057	185.00
200	59010	131.00	59026	157.00	59042	159.00	59058	185.00
300	59011	208.00	59027	239.00	59043	247.00	59059	278.00
400	59012	208.00	59028	239.00	59044	247.00	59060	278.00
500	59013	208.00	59029	239.00	59045	247.00	59061	278.00
600	59014	237.00	59030	273.00	59046	295.00	59062	331.00
800	59015	300.00	59031	336.00	59047	348.00	59063	384.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT AND ALTERNATING CURRENT (BARRIERS BETWEEN POLES)							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	59080	\$108.00	59096	\$132.00	59112	\$138.00	59128	\$162.00
10	59081	108.00	59097	132.00	59113	138.00	59129	162.00
15	59082	108.00	59098	132.00	59114	138.00	59130	162.00
20	59083	108.00	59099	132.00	59115	138.00	59131	162.00
30	59084	108.00	59100	132.00	59116	138.00	59132	162.00
45	59085	108.00	59101	132.00	59117	138.00	59133	162.00
60	59086	108.00	59102	132.00	59118	138.00	59134	162.00
80	59087	108.00	59103	132.00	59119	138.00	59135	162.00
100	59088	135.00	59104	161.00	59120	170.00	59136	196.00
150	59089	135.00	59105	161.00	59121	170.00	59137	196.00
200	59090	135.00	59106	161.00	59122	170.00	59138	196.00
300	59091	212.00	59107	243.00	59123	259.00	59139	290.00
400	59092	212.00	59108	243.00	59124	259.00	59140	290.00
500	59093	212.00	59109	243.00	59125	259.00	59141	290.00
600	59094	241.00	59110	277.00	59126	307.00	59142	343.00
800	59095	304.00	59111	340.00	59127	360.00	59143	396.00

*Prices on capacities over 800 amperes quoted on application.

†On two pole time limit breakers, one pole has time limit and the other pole has none, but the overload armature is heavily weighted so that an overload on *this* pole will not trip the breaker unless it assumes short circuit proportions. If *both* poles are wanted with time limit add the following *list* prices to the above figures covering "Plain overload, time limit" or "Overload and undervoltage, time limit" breakers:

5 to 80 amperes	\$23.50
100 to 200	26.00
300 to 500	31.00
600 to 800	36.00

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ES

DOUBLE POLE, DOUBLE COIL, RIGID ARM

*800 AMPERES AND UNDER

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	† Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	† Overload and Undervoltage Time Limit
5	59200	\$104.00	59216	\$128.00	59232	\$127.00	59248	\$151.00
10	59201	104.00	59217	128.00	59233	127.00	59249	151.00
15	59202	104.00	59218	128.00	59234	127.00	59250	151.00
20	59203	104.00	59219	128.00	59235	127.00	59251	151.00
30	59204	104.00	59220	128.00	59236	127.00	59252	151.00
45	59205	104.00	59221	128.00	59237	127.00	59253	151.00
60	59206	104.00	59222	128.00	59238	127.00	59254	151.00
80	59207	104.00	59223	128.00	59239	127.00	59255	151.00
100	59208	131.00	59224	157.00	59240	159.00	59256	185.00
150	59209	131.00	59225	157.00	59241	159.00	59257	185.00
200	59210	131.00	59226	157.00	59242	159.00	59258	185.00
300	59211	208.00	59227	239.00	59243	247.00	59259	278.00
400	59212	208.00	59228	239.00	59244	247.00	59260	278.00
500	59213	208.00	59229	239.00	59245	247.00	59261	278.00
600	59214	237.00	59230	273.00	59246	295.00	59262	331.00
800	59215	300.00	59231	336.00	59247	348.00	59263	384.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT AND ALTERNATING CURRENT (BARRIERS BETWEEN POLES)							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	† Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	† Overload and Undervoltage Time Limit
5	59280	\$108.00	59296	\$132.00	59312	\$138.00	59328	\$162.00
10	59281	108.00	59297	132.00	59313	138.00	59329	162.00
15	59282	108.00	59298	132.00	59314	138.00	59330	162.00
20	59283	108.00	59299	132.00	59315	138.00	59331	162.00
30	59284	108.00	59300	132.00	59316	138.00	59332	162.00
45	59285	108.00	59301	132.00	59317	138.00	59333	162.00
60	59286	108.00	59302	132.00	59318	138.00	59334	162.00
80	59287	108.00	59303	132.00	59319	138.00	59335	162.00
100	59288	135.00	59304	161.00	59320	170.00	59336	196.00
150	59289	135.00	59305	161.00	59321	170.00	59337	196.00
200	59290	135.00	59306	161.00	59322	170.00	59338	196.00
300	59291	212.00	59307	243.00	59323	259.00	59339	290.00
400	59292	212.00	59308	243.00	59324	259.00	59340	290.00
500	59293	212.00	59309	243.00	59325	259.00	59341	290.00
600	59294	241.00	59310	277.00	59326	307.00	59342	343.00
800	59295	304.00	59311	340.00	59327	360.00	59343	396.00

*Prices on capacities over 800 amperes quoted on application.

†On two pole time limit breakers, one pole has time limit and the other pole has none, but the overload armature is heavily weighted so that an overload on *this* pole will not trip the breaker unless it assumes short circuit proportions. If *both* poles are wanted with time limit add the following *list* prices to the above figures covering "Plain overload, time limit" or "Overload and undervoltage, time limit" breakers:

5 to 80 amperes.....	\$23.50
100 to 200 ".....	26.00
300 to 500 ".....	31.00
600 to 800 ".....	36.00

For free handle attachments and targets add to the list price of the breaker selected the following added *list* charges:

5 to 80 amperes.....	\$14.50
100 to 200 ".....	17.50
300 to 500 ".....	24.50
600 to 800 ".....	24.50

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C. the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS Type ES THREE POLE, THREE COIL, RIGID ARM *800 AMPERES AND UNDER

250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT								
Rated Ampere Capacity	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	59400	\$136.00	59416	\$183.00	59432	\$161.00	59448	\$208.00
10	59401	136.00	59417	183.00	59433	161.00	59449	208.00
15	59402	136.00	59418	183.00	59434	161.00	59450	208.00
20	59403	136.00	59419	183.00	59435	161.00	59451	208.00
30	59404	136.00	59420	183.00	59436	161.00	59452	208.00
45	59405	136.00	59421	183.00	59437	161.00	59453	208.00
60	59406	136.00	59422	183.00	59438	161.00	59454	208.00
80	59407	136.00	59423	183.00	59439	161.00	59455	208.00
100	59408	180.00	59424	232.00	59440	212.00	59456	264.00
150	59409	180.00	59425	232.00	59441	212.00	59457	264.00
200	59410	180.00	59426	232.00	59442	212.00	59458	264.00
300	59411	278.00	59427	340.00	59443	350.00	59459	412.00
400	59412	278.00	59428	340.00	59444	350.00	59460	412.00
500	59413	278.00	59429	340.00	59445	350.00	59461	412.00
600	59414	334.00	59430	406.00	59446	405.00	59462	477.00
800	59415	416.00	59431	488.00	59447	502.00	59463	574.00

250-600 VOLTS, DIRECT AND ALTERNATING CURRENT (BARRIERS BETWEEN POLES)								
Rated Ampere Capacity	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	†Overload and Undervoltage Time Limit
5	59480	\$144.00	59496	\$191.00	59512	\$177.00	59528	\$224.00
10	59481	144.00	59497	191.00	59513	177.00	59529	224.00
15	59482	144.00	59498	191.00	59514	177.00	59530	224.00
20	59483	144.00	59499	191.00	59515	177.00	59531	224.00
30	59484	144.00	59500	191.00	59516	177.00	59532	224.00
45	59485	144.00	59501	191.00	59517	177.00	59533	224.00
60	59486	144.00	59502	191.00	59518	177.00	59534	224.00
80	59487	144.00	59503	191.00	59519	177.00	59535	224.00
100	59488	188.00	59504	240.00	59520	228.00	59536	280.00
150	59489	188.00	59505	240.00	59521	228.00	59537	280.00
200	59490	188.00	59506	240.00	59522	228.00	59538	280.00
300	59491	286.00	59507	348.00	59523	372.00	59539	434.00
400	59492	286.00	59508	348.00	59524	372.00	59540	434.00
500	59493	286.00	59509	348.00	59525	372.00	59541	434.00
600	59494	342.00	59510	414.00	59526	418.00	59542	490.00
800	59495	424.00	59511	496.00	59527	524.00	59543	596.00

*Prices on capacities over 800 amperes quoted on application.

†On three pole time limit breakers, two poles have time limits and the other (the center one) has none, but the overload armature is heavily weighted so that an overload on *that* pole will not trip the breaker unless it assumes short circuit proportions.

For free handle attachments and targets add to the list price of the breaker selected the following added list charge:

5 to 80 amperes.....	\$19.50
100 to 200 "	24.00
300 to 500 "	34.50
600 to 800 "	34.50

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

RELAYS

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type ES

FOUR POLE, FOUR COIL, RIGID ARM

*800 AMPERES AND UNDER

Rated Ampere Capacity	250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	† Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	† Overload and Undervoltage Time Limit
5	59600	\$177.00	59616	\$224.00	59632	\$220.00	59648	\$267.00
10	59601	177.00	59617	224.00	59633	220.00	59649	267.00
15	59602	177.00	59618	224.00	59634	220.00	59650	267.00
20	59603	177.00	59619	224.00	59635	220.00	59651	267.00
30	59604	177.00	59620	224.00	59636	220.00	59652	267.00
45	59605	177.00	59621	224.00	59637	220.00	59653	267.00
60	59606	177.00	59622	224.00	59638	220.00	59654	267.00
80	59607	177.00	59623	224.00	59639	220.00	59655	267.00
100	59608	223.00	59624	275.00	59640	278.00	59656	330.00
150	59609	223.00	59625	275.00	59641	278.00	59657	330.00
200	59610	223.00	59626	275.00	59642	278.00	59658	330.00
300	59611	362.00	59627	424.00	59643	441.00	59659	503.00
400	59612	362.00	59628	424.00	59644	441.00	59660	503.00
500	59613	362.00	59629	424.00	59645	441.00	59661	503.00
600	59614	446.00	59630	518.00	59646	519.00	59662	591.00
800	59615	556.00	59631	628.00	59647	654.00	59663	726.00

Rated Ampere Capacity	250-600 VOLTS, DIRECT AND ALTERNATING CURRENT (BARRIERS BETWEEN POLES)							
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	† Plain Overload Time Limit	Cat. No.	Overload and Undervoltage Inst. Trip	Cat. No.	† Overload and Undervoltage Time Limit
5	59680	\$189.00	59696	\$236.00	59712	\$246.00	59728	\$293.00
10	59681	189.00	59697	236.00	59713	246.00	59729	293.00
15	59682	189.00	59698	236.00	59714	246.00	59730	293.00
20	59683	189.00	59699	236.00	59715	246.00	59731	293.00
30	59684	189.00	59700	236.00	59716	246.00	59732	293.00
45	59685	189.00	59701	236.00	59717	246.00	59733	293.00
60	59686	189.00	59702	236.00	59718	246.00	59734	293.00
80	59687	189.00	59703	236.00	59719	246.00	59735	293.00
100	59688	235.00	59704	287.00	59720	305.00	59736	357.00
150	59689	235.00	59705	287.00	59721	305.00	59737	357.00
200	59690	235.00	59706	287.00	59722	305.00	59738	357.00
300	59691	374.00	59707	436.00	59723	466.00	59739	528.00
400	59692	374.00	59708	436.00	59724	466.00	59740	528.00
500	59693	374.00	59709	436.00	59725	466.00	59741	528.00
600	59694	458.00	59710	530.00	59726	532.00	59742	604.00
800	59695	568.00	59711	640.00	59727	681.00	59743	753.00

*Prices on capacities over 800 amperes quoted on application.

†On four pole time limit breakers, two poles have time limits and the other two (the center ones) have none, but the overload armatures are heavily weighted so that an overload on these two poles will not trip the breaker unless it assumes short circuit proportions.

For free handle attachments and targets add to the list price of the breaker selected the following added list charge:

5 to 80 amperes.....	\$24.50
100 to 200	30.50
300 to 500	44.50
600 to 800	44.50

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

For data on shunt trip breakers, shock proof breakers, circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Type EI

Roller-Smith Type EI (Enclosed Industrial) circuit breakers are made in capacities from 3 to 100 amperes. They are small and inexpensive, but will give excellent service under the conditions for which they were designed.

They are generally similar to the Type ES except that the breaker itself is the well-known Industrial Type instead of the Standard Type.

The Type EI does not have the fine finish of the Type ES, but all parts are dipped and lacquered. They are built for *hard work*.

Type EI breakers cannot be supplied with free handle nor with time limit. Styles and combinations available are confined to those listed.

*100 AMPERES AND UNDER

*250 VOLTS AND UNDER, DIRECT AND ALTERNATING CURRENT

Rated Ampere Capacity	SINGLE POLE				DOUBLE POLE, DOUBLE COIL, INDEPENDENT ARM			
	Cat. No.	Plain Overload	Cat. No.	Overload and Undervoltage	Cat. No.	Plain Overload	Cat. No.	Overload and Undervoltage
3	59800	\$49.00	59809	\$61.00	59818	\$70.00	59827	\$82.00
5	59801	49.00	59810	61.00	59819	70.00	59828	82.00
10	59802	49.00	59811	61.00	59820	70.00	59829	82.00
15	59803	49.00	59812	61.00	59821	70.00	59830	82.00
30	59804	49.00	59813	61.00	59822	70.00	59831	82.00
45	59805	49.00	59814	61.00	59823	70.00	59832	82.00
60	59806	49.00	59815	61.00	59824	70.00	59833	82.00
80	59807	49.00	59816	61.00	59825	70.00	59834	82.00
100	59808	63.00	59817	75.00	59826	92.00	59835	104.00

Rated Ampere Capacity	DOUBLE POLE, DOUBLE COIL, RIGID ARM				THREE POLE, THREE COIL, RIGID ARM				FOUR POLE, FOUR COIL, RIGID ARM			
	Cat. No.	Plain Over- load	Cat. No.	Over- load and Under- voltage	Cat. No.	Plain Over- load	Cat. No.	Over- load and Under- voltage	Cat. No.	Plain Over- load	Cat. No.	Over- load and Under- voltage
3	59832	\$70.00	59841	\$82.00	59850	\$92.00	59859	\$104.00	59868	\$113.00	59877	\$137.00
5	59833	70.00	59842	82.00	59851	92.00	59860	104.00	59869	113.00	59878	137.00
10	59834	70.00	59843	82.00	59852	92.00	59861	104.00	59870	113.00	59879	137.00
15	59835	70.00	59844	82.00	59853	92.00	59862	104.00	59871	113.00	59880	137.00
30	59836	70.00	59845	82.00	59854	92.00	59863	104.00	59872	113.00	59881	137.00
45	59837	71.00	59846	82.00	59855	92.00	59864	104.00	59873	113.00	59882	137.00
60	59838	70.00	59847	82.00	59856	92.00	59865	104.00	59874	113.00	59883	137.00
80	59839	70.00	59848	82.00	59857	92.00	59866	104.00	59875	113.00	59884	137.00
100	59840	92.00	59849	104.00	59858	115.00	59867	127.00	59876	147.00	59885	161.00

*For capacities over 100 amperes and for potentials over 250 volts see preceding pages.

In ordering specify quantity, catalog number, whether for A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

For circuit opening and circuit closing auxiliary switches, see page 18.

For data on "The Breaker to Use" see page 19.

Note—Type EI breakers cannot be supplied with time limits, with free handle attachments, nor are they supplied in the shock proof or shunt trip styles. If any of these features are desired the Types ESF and ES are recommended. See preceding pages.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

Accessories

Shunt Trip Attachments for Types ESF and ES Enclosed Circuit Breakers

As a rule Types ESF and ES can be supplied with shunt trip attachments in the same combinations and at about the same prices as the overload and undervoltage styles, but definite prices will be quoted on application.

Auxiliary Switches for Types ESF, ES and EI Enclosed Circuit Breakers

These are small switches which are actuated by the moving contact arm. They operate the auxiliary circuit and are made in two forms: One opens when the breaker opens and one closes when the breaker opens. They are frequently used to operate alarm bells, signal lamps and similar devices and are used also to open the shunt-trip coil circuit when the shunt-trip breaker is in its open position. The tripping coil of a shunt-trip breaker cannot be left indefinitely in circuit without risk of burning out. Our auxiliary switch opening when the breaker opens is recommended on such installations.

List prices are as follows:

3 to 80 amperes.....	\$11.00
100 " 200 "	11.00
300 " 500 "	12.00
600 " 800 "	12.00

Prices for capacities over 800 amperes will be quoted on application.

Back Connected Enclosed Circuit Breakers

Any listed Type ESF, ES or EI circuit breaker can be supplied with rear studs projecting through the back of the box, this form of connection sometimes being wanted when breakers are to be mounted on iron framework instead of on the wall. Prices on application.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS

NUMBER OF POLES TO USE:

ON TWO WIRE CIRCUITS: A single pole, plain overload breaker gives protection and will save the fuses, but a fused knife switch must then also be employed. A double pole circuit breaker gives full automatic protection and switches can frequently be dispensed with. The independent arm type is usually to be preferred, as one pole can be closed at a time, and should an overload or short circuit exist, the pole first closed will open immediately after the other pole is closed. A rigid arm breaker may, however, be used, if so desired, if a knife switch is used also.

ON THREE WIRE CIRCUITS: On any three wire, A. C. or D. C. circuit a rigid arm, three pole breaker is generally used, but a two pole, rigid arm device may be used under certain conditions.

ON TWO PHASE, FOUR WIRE CIRCUITS: A four pole, rigid arm breaker is usually desirable, but frequently a two pole, rigid arm breaker is satisfactory if so connected as to effectively open one wire of each phase.

BREAKER CAPACITY TABLE

The following table shows the ampere capacity of breakers to be used for the protection of motors. Necessarily, average and not extreme values of motor efficiency had to be selected, but in general the table will be found conservative.

H. P.	D. C.			Single Phase A. C.		Two-Phase—4 Wire A. C.			Three-Phase—3 Wire A. C.		
	Voltage			Voltage		Voltage			Voltage		
	110	220	500	110	220	110	220	440	110	220	440
1	10	5	3	15	10	10	5	3	10	5	3
2	30	10	5	30	15	15	10	5	15	10	5
3	30	15	10	45	30	30	15	5	30	15	10
5	45	30	10	60	30	30	15	10	45	20	10
7.5	60	30	20	80	45	45	30	10	45	30	20
10	80	45	30	100	60	60	30	20	60	30	20
15	150	60	30	150	80	80	45	20	80	45	30
20	150	80	45	200	100	100	60	30	100	60	30
25	200	100	45	200	100	150	60	45	150	80	45
30	300	150	60	300	150	150	80	45	150	80	45
50	400	200	80	500	300	300	150	80	300	150	80
75	600	300	150	600	400	400	200	100	400	200	100
100	800	400	200	800	500	500	300	150	500	300	150

Data for two phase, three wire motors furnished on application.

ROLLER-SMITH Products comprise complete lines of Electrical Instruments, Relays and Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY,
BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees all its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Representatives

Sales Offices

BOSTON	88 Broad Street	NEW ORLEANS	Masonic Temple
BUFFALO	Ellicott Square Building	OMAHA	W. O. W. Building
CHICAGO	55 W. Jackson Bldg.	PHILADELPHIA	Otis Building
CLEVELAND	1988 E. 66th Street	PITTSBURGH	Westinghouse Bldg.
DENVER	Kittridge Bldg.	ST. LOUIS	Natl. Bk. of Com. Bldg.
DETROIT	Fisher Building	ST. PAUL	Pioneer Building
HOUSTON	1006 Washington Avenue	SAN FRANCISCO	163-2nd Street
LOS ANGELES	443½ E. Third Street	SEATTLE	Alaska Bldg.
MONTREAL	Power Building	TORONTO	183 George Street
NEW YORK	233 Broadway	TULSA	217 Archer Street
	WASHINGTON		Evening Star Bldg.

ABROAD

THRELL ELECTRIC COMPANY	Box 2049, Havana, Cuba
DUVAL TRADING CO.	Kembla Bldgs., Sydney, Australia
ASHIDA ENGINEERING CO.	Daini, Osaka, Japan
MANILA MACHINERY & SUPPLY CO.,	Box 607, Manila, Philippine Islands

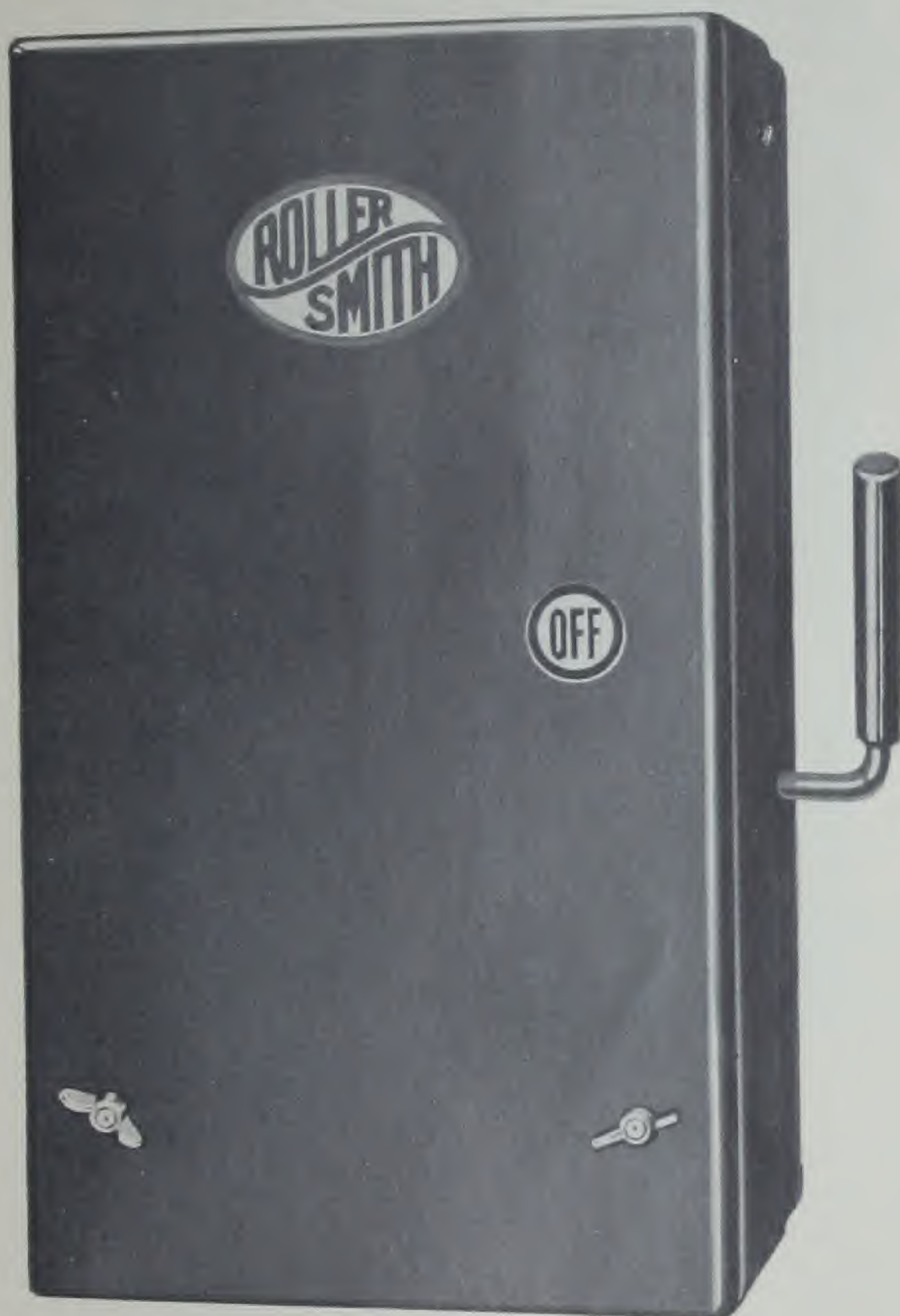




Supplement No. 1 to
BULLETIN NO. 580
January, 1929

ENCLOSED CIRCUIT BREAKERS Type EAF (Free Handle)

80 Amperes and Less
250 Volts and Less D.C., 550 Volts and Less A.C.
Two and Three Pole



Exterior View

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK

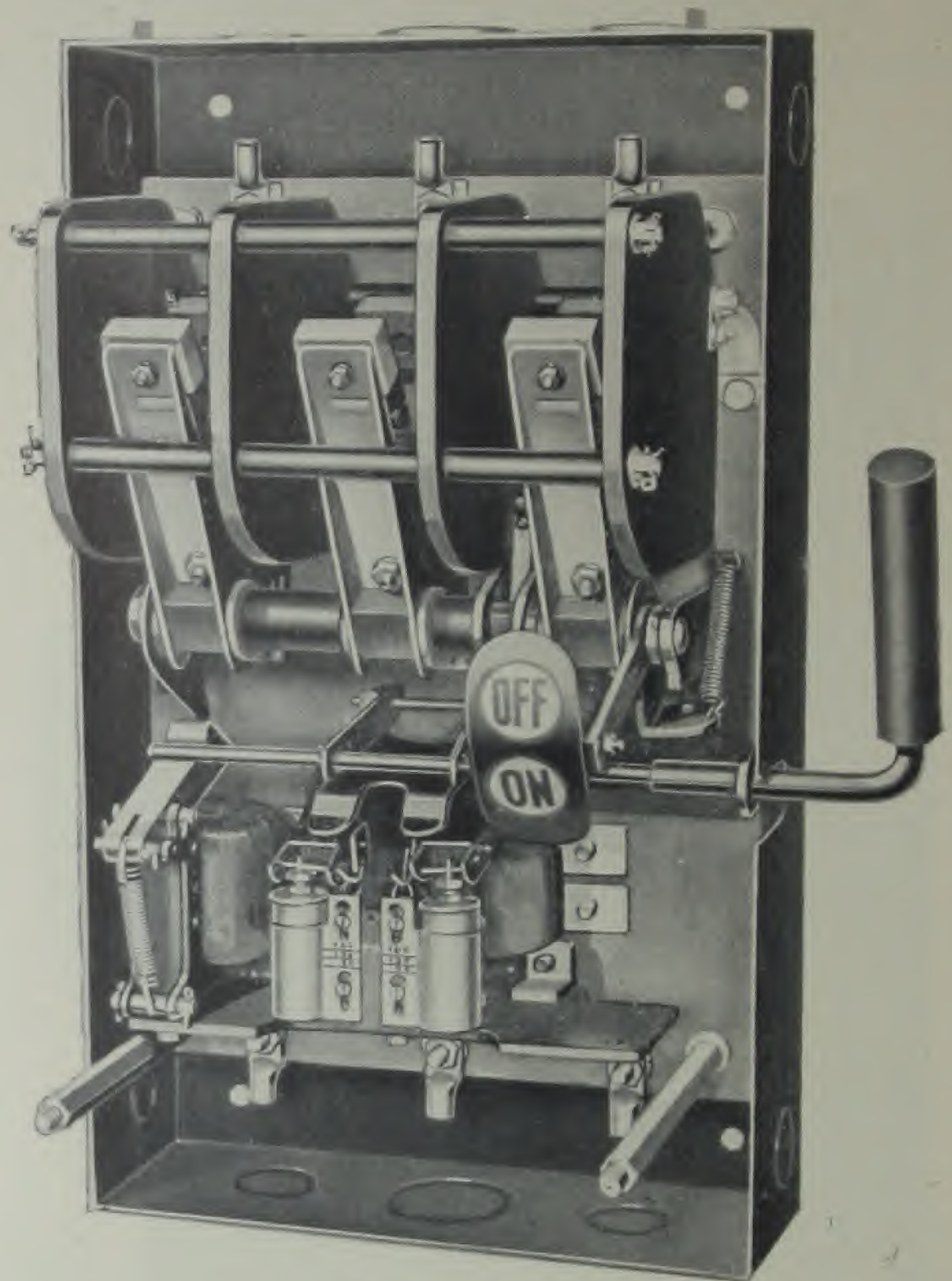


WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS Type EAF (Free Handle)

80 Amperes and Less
250 Volts and Less D.C., 550 Volts and Less A.C.
Two and Three Pole



Interior View

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ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS Type EAF (Free Handle)

80 Amperes and Less

250 Volts and Less D.C., 550 Volts and Less A.C.

Two and Three Pole

TYPE EAF CIRCUIT BREAKER

General Description

The Type EAF breaker is a circuit breaker designed primarily for industrial work, such as the protection of motor and lighting circuits. To comply with the requirements of the industrial field such a breaker must be enclosed, rugged in construction, compact in size and moderately priced. It must provide time limit and non-closable on overload protection. The Type EAF embodies all of these features.

Installation

The Type EAF breaker is enclosed in a two-piece steel case so designed that the cover may be completely removed from the bottom by simply taking off two wing nuts. The lower section of the case is equipped with three knock-outs on both the top and bottom and two knock-outs on each side. This liberal allotment of knock-outs will accommodate practically any arrangement of wiring or conduits. The breaker may be mounted on a wall, post or supporting frame by means of four $\frac{1}{4}$ " screws. The breaker proper is mounted on a slate panel and this panel may be removed from the case by taking out four corner screws, so that if the installer prefers having the breaker out of the case during the process of pulling in the leads, soldering on cable lugs, etc., this can be done without any complications. The fact that the breaker proper can be removed from the case by the removal of four screws is an advantage, also, in that at any future time breakers of different capacity can be interchanged without disturbing the wiring or conduit leading to the breaker box.

Method of Operation

The Type EAF breaker is closed by pressing down an insulated handle, which projects from the right hand side of the case. Knocking the handle upwards opens the breaker. There are no other operating knobs or devices to be manipulated. A target indicates the "Open" or "Closed" position.

Barriers

All Type EAF breakers are equipped with a barrier unit separating the arcing members from each other. This unit may be removed without tools by simply lifting up on the sides of the structure, disengaging two spring hooks. In this manner it is possible to instantly inspect the contact members and carbons.

STYLES OF TRIPS

Non-Closable on Overload

First of all, the Type EAF breaker is essentially a non-closable on overload type of breaker. In other words the breaker cannot be held closed against an overload.

Overload Protection

The Type EAF breaker is built in either two or three pole combinations. Two overload coils are standard equipment in either case. The two and three pole breakers are exactly the same size, the only difference being that the centre pole is omitted in the case of a two pole combination. The overload trip consists of extremely efficient electro-magnets, whose armatures may be set at the different points of calibration by means of two set screws. Breakers are calibrated from the normal rating point to a point 100% in excess of normal. The overload coil units are such that they may be replaced in the field, either with others of the same size, or ones of a different capacity. For example: A breaker originally shipped from the factory as a 10 ampere one can be changed later to a 30 ampere size by the simple substitution of 30 ampere units, this being accomplished by removing four screws and four nuts.

Time Limit Protection

Time limit protection is afforded by means of extremely simple and efficient dashpots, whose outstanding characteristics are quickness in resetting and freedom from oil overflow. But a few drops of oil are sufficient to fill the oil chamber. Extra oil can be added by means of a small oil can, which accompanies each breaker.

Under-Voltage Protection

Either one or two under-voltage attachments can be placed on any Type EAF breaker without modifying the original structure. The under-voltage attachments are held in place by means of two screws accessible from the front. On standard three pole breakers one under-voltage unit is supplied, unless otherwise stated.

Shunt Trip

If it is desired to open a Type EAF breaker from a distance by means of a shunt coil, this can be accomplished by having the specifications call for a shunt trip feature. This device can be added to the standard Type EAF breaker without modifying the original equipment and the shunt trip attachment is held in place by two screws.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS Type EAF (Free Handle)

****80 Amperes and Less**

250 Volts and Less D.C., 550 Volts and Less A.C.

TWO POLE, TWO COIL

††Rated Ampere Capacity	250 Volts and Under D.C., 550 Volts and Under A.C.			
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit
1/2	58150	\$45.00	58165	\$50.00
1	58151	45.00	58166	50.00
2	58152	45.00	58167	50.00
3	58153	45.00	58168	50.00
4	58154	45.00	58169	50.00
5	58155	45.00	58170	50.00
6	58156	45.00	58171	50.00
8	58157	45.00	58172	50.00
10	58158	45.00	58173	50.00
15	58159	45.00	58174	50.00
20	58160	45.00	58175	50.00
30	58161	45.00	58176	50.00
45	58162	48.00	58177	53.00
60	58163	50.00	58178	55.00
80	58164	52.00	58179	57.00

††Rated Ampere Capacity	250 Volts and Under D.C., 550 Volts and Under A.C.			
	Cat. No.	*Overload and Under Voltage Inst. Trip	Cat. No.	†*Overload and Under Voltage Time Limit
1/2	58180	\$58.00	58195	\$63.00
1	58181	58.00	58196	63.00
2	58182	58.00	58197	63.00
3	58183	58.00	58198	63.00
4	58184	58.00	58199	63.00
5	58185	58.00	58351	63.00
6	58186	58.00	58352	63.00
8	58187	58.00	58353	63.00
10	58188	58.00	58354	63.00
15	58189	58.00	58355	63.00
20	58190	58.00	58356	63.00
30	58191	58.00	58357	63.00
45	58192	61.00	58358	66.00
60	58193	63.00	58359	68.00
80	58194	65.00	58360	71.00

† Two time limit attachments supplied.

* One undervoltage attachment supplied.

†† Range of overload adjustment from normal rating to twice normal rating.

** For circuit breakers in capacities over 80 amperes refer to Bulletin No. 580.

In ordering, specify quantity, catalog number, whether A.C. or D.C. and, if A.C. the frequency and number of phases and wires; normal operating voltage.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS Type EAF (Free Handle)

****80 Amperes and Less**

250 Volts and Less D.C., 550 Volts and Less A.C.

THREE POLE, TWO COIL

††Rated Ampere Capacity	250 Volts and Under D.C., 550 Volts and Under A.C.			
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit
1/2	58361	\$67.00	58376	\$72.00
1	58362	67.00	58377	72.00
2	58363	67.00	58378	72.00
3	58364	67.00	58379	72.00
4	58365	67.00	58380	72.00
5	58366	67.00	58381	72.00
6	58367	67.00	58382	72.00
8	58368	71.00	58383	76.00
10	58369	71.00	58384	76.00
15	58370	74.00	58385	79.00
20	58371	74.00	58386	79.00
30	58372	78.00	58387	84.00
45	58373	80.00	58388	85.00
60	58374	80.00	58389	85.00
80	58375	89.00	58390	94.00

††Rated Ampere Capacity	250 Volts and Under D.C., 550 Volts and Under A.C.			
	Cat. No.	*Overload and Under Voltage Inst. Trip	Cat. No.	†*Overload and Under Voltage Time Limit
1/2	58391	\$80.00	58557	\$89.00
1	58392	80.00	58558	89.00
2	58393	80.00	58559	89.00
3	58394	80.00	58560	89.00
4	58395	80.00	58561	89.00
5	58396	80.00	58562	89.00
6	58397	80.00	58563	89.00
8	58398	84.00	58564	89.00
10	58399	84.00	58565	89.00
15	58551	91.00	58566	96.00
20	58552	91.00	58567	96.00
30	58553	92.00	58568	97.00
45	58554	94.00	58569	99.00
60	58555	94.00	58570	99.00
80	58556	101.00	58571	104.00

† Two time limit attachments supplied.
 * One undervoltage attachment supplied.
 †† Range of overload adjustment from normal rating to twice normal rating.
 ** For circuit breakers in capacities over 80 amperes refer to Bulletin No. 580.
In ordering, specify quantity, catalog number, whether A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

ROLLER-SMITH ENCLOSED CIRCUIT BREAKERS Type EAF (Free Handle)

NUMBER OF POLES TO USE

On Two Wire Circuits: A single pole circuit breaker gives protection and will save the fuses, but a fused knife switch must also be used. (For listing of single pole breakers see Bulletin No. 580.) A double pole circuit breaker gives full automatic protection and, with the "free handle" feature employed on the Type EAF, knife switches can be dispensed with. In case the breaker is closed when a short circuit or overload exists it will immediately trip even though the handle is held in the closed position.

On Three Wire Circuits: On any three wire A.C. or D.C. circuit a three pole breaker is generally used, but a two pole device may be used under certain conditions.

On Two Phase, Four Wire Circuits: A two pole breaker is satisfactory if so connected as to effectively open one wire of each phase. A four pole breaker should be used if it is necessary to open all four wires. For listing of four pole breakers see Bulletin No. 580.

BREAKER CAPACITY TABLE

The following table shows the ampere capacity of breakers to be used for the protection of motors. Necessarily average and not extreme values of motor efficiency had to be selected, but in general the table will be found conservative.

H. P.	D. C.			Single Phase A. C.		Two Phase—4 Wire A. C.			Three Phase—3 Wire A. C.		
	Voltage			Voltage		Voltage			Voltage		
	110	220	500	110	220	110	220	440	110	220	440
1	10	5	3	15	10	10	5	3	10	5	3
2	30	10	5	30	15	15	10	5	15	10	5
3	30	15	10	45	30	30	15	5	30	15	10
5	45	30	10	60	30	30	15	10	45	20	10
7.5	60	30	20	80	45	45	30	10	45	30	20
10	80	45	30	100	60	60	30	20	60	30	20
15	150	60	30	150	80	80	45	20	80	45	30
20	150	80	45	200	100	100	60	30	100	60	30
25	200	100	45	200	100	150	60	45	150	80	45
30	300	150	60	300	150	150	80	45	150	80	45
50	400	200	80	500	300	300	150	80	300	150	80
75	600	300	150	600	400	400	200	100	400	200	100
100	800	400	200	800	500	500	300	150	500	300	150

Data for 2 phase, 3 wire motors furnished on application.

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ROLLER-SMITH Representatives

Sales Offices

ATLANTA . . .	101 Marietta Street	NEW YORK . . .	233 Broadway
BOSTON . . .	88 Broad Street	NEW ORLEANS . . .	Masonic Temple
BUFFALO . . .	Ellicott Square Building	OMAHA . . .	W. O. W. Building
CHICAGO . . .	58 W. Jackson Blvd.	PHILADELPHIA . . .	Otis Building
CLEVELAND . . .	1988 E. 66th Street	PITTSBURGH . . .	First Nat. Bank Bldg.
DENVER . . .	Kittridge Building	ST. LOUIS . . .	Natl. Bk. of Com. Bldg.
DETROIT . . .	Fisher Building	ST. PAUL . . .	Pioneer Building
HOUSTON . . .	1006 Washington Avenue	SAN FRANCISCO . . .	163-2nd Street
LOS ANGELES . . .	912 E. Third Street	SEATTLE . . .	Alaska Building
MONTREAL . . .	Tramway Building	TORONTO . . .	188 George Street

ABROAD

ASHIDA ENGINEERING CO. Daini, Osaka, Japan



Roller-Smith Enclosed Circuit Breakers Type EAF (Free Handle)

**80 Amperes and Less

250 Volts and Less D.C., 550 Volts and Less A.C.

THREE POLE, THREE COIL

††Rated Ampere Capacity	250 VOLTS AND UNDER D.C., 550 VOLTS AND UNDER A.C.			
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time limit
1/2	58751	\$73.00	58766	\$83.00
1	58752	73.00	58767	83.00
2	58753	73.00	58768	83.00
3	58754	73.00	58769	83.00
4	58755	73.00	58770	83.00
5	58756	73.00	58771	83.00
6	58757	73.00	58772	83.00
8	58758	77.00	58773	87.00
10	58759	77.00	58774	87.00
15	58760	80.00	58775	90.00
20	58761	80.00	58776	90.00
30	58762	84.00	58777	95.00
45	58763	86.00	58778	96.00
60	58764	86.00	58779	96.00
80	58765	95.00	58780	105.00

††Rated Ampere Capacity	250 VOLTS AND UNDER D.C., 550 VOLTS AND UNDER A.C.			
	Cat. No.	*Overload and Undervoltage Inst. Trip	Cat. No.	†*Overload and Undervoltage Time Limit
1/2	58781	\$86.00	58796	\$100.00
1	58782	86.00	58797	100.00
2	58783	86.00	58798	100.00
3	58784	86.00	58799	100.00
4	58785	86.00	58951	100.00
5	58786	86.00	58952	100.00
6	58787	86.00	58953	100.00
8	58788	90.00	58954	100.00
10	58789	90.00	58955	100.00
15	58790	97.00	58956	107.00
20	58791	97.00	58957	107.00
30	58792	98.00	58958	108.00
45	58793	100.00	58959	110.00
60	58794	100.00	58960	110.00
80	58795	107.00	58961	115.00

† Two time limit attachments supplied.
* One undervoltage attachment supplied.
†† Range of overload adjustment from normal rating to twice normal rating.
** For circuit breakers in capacities over 80 amperes refer to Bulletin No. 580.
In Ordering specify quantity, catalog number, whether A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

ROLLER-SMITH COMPANY Electrical Measuring and Protective Apparatus

MAIN OFFICE: 233 Broadway, NEW YORK  WORKS: Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada
Representatives in
Australia, Cuba, Japan and Philippine Islands

Roller-Smith Enclosed Circuit Breakers Type EAF (Free Handle)

**80 Amperes and Less

250 Volts and Less D.C., 550 Volts and Less A.C.

FOUR POLE, TWO COIL

††Rated Ampere Capacity	250 VOLTS AND UNDER D.C., 550 VOLTS AND UNDER A.C.			
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit
1/2	58962	\$78.00	58977	\$88.00
1	58963	78.00	58978	88.00
2	58964	78.00	58979	88.00
3	58965	78.00	58980	88.00
4	58966	78.00	58981	88.00
5	58967	78.00	58982	88.00
6	58968	78.00	58983	88.00
8	58969	82.00	58984	92.00
10	58970	82.00	58985	92.00
15	58971	85.00	58986	95.00
20	58972	85.00	58987	95.00
30	58973	89.00	58988	100.00
45	58974	91.00	58989	101.00
60	58975	91.00	58990	101.00
80	58976	100.00	58991	110.00

††Rated Ampere Capacity	250 VOLTS AND UNDER D.C., 550 VOLTS AND UNDER A.C.			
	Cat. No.	*Overload and Undervoltage Inst. Trip	Cat. No.	†*Overload and Undervoltage Time Limit
1/2	58992	\$91.00	59158	\$105.00
1	58993	91.00	59159	105.00
2	58994	91.00	59160	105.00
3	58995	91.00	59161	105.00
4	58996	91.00	59162	105.00
5	58997	91.00	59163	105.00
6	58998	91.00	59164	105.00
8	58999	95.00	59165	105.00
10	59151	95.00	59166	105.00
15	59152	102.00	59167	112.00
20	59153	102.00	59168	112.00
30	59154	103.00	59169	113.00
45	59155	105.00	59170	115.00
60	59156	105.00	59171	115.00
80	59157	112.00	59172	120.00

† Two time limit attachments supplied.

* One undervoltage attachment supplied.

†† Range of overload adjustment from normal rating to twice normal rating.

** For circuit breakers in capacities over 80 amperes refer to Bulletin No. 580.

In Ordering specify quantity, catalog number, whether A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

Roller-Smith Enclosed Circuit Breakers
Type EAF (Free Handle)

**80 Amperes and Less

250 Volts and Less D.C., 550 Volts and Less A.C.

FOUR POLE, FOUR COIL

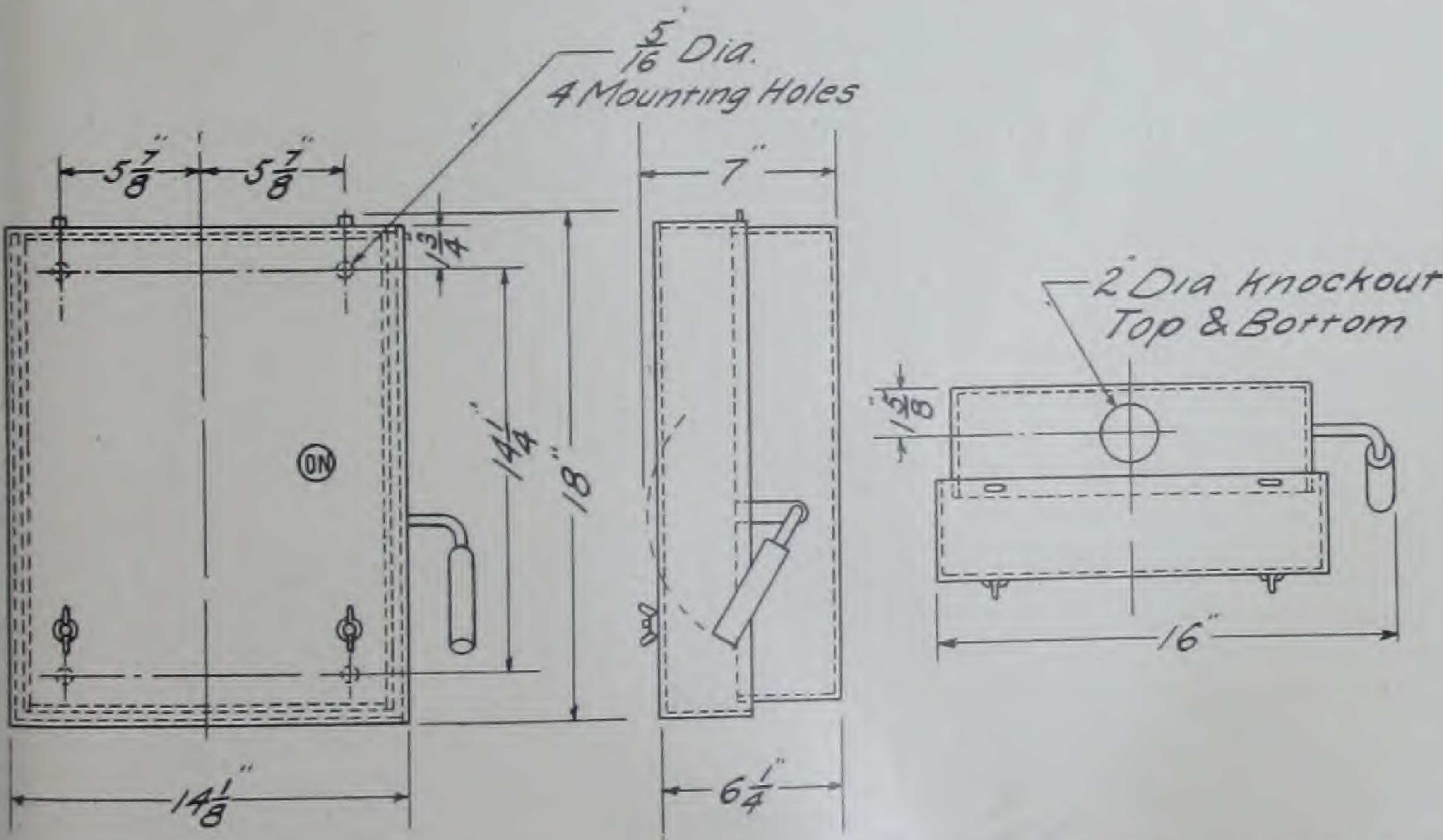
††Rated Ampere Capacity	250 VOLTS AND UNDER D.C., 550 VOLTS AND UNDER A.C.			
	Cat. No.	Plain Overload Inst. Trip	Cat. No.	†Plain Overload Time Limit
1/2	59173	\$90.00	59186	\$110.00
1	59174	90.00	59187	110.00
2	59175	90.00	59188	110.00
3	59176	90.00	59189	110.00
4	59177	90.00	59190	110.00
5	59178	90.00	59191	110.00
6	59177	90.00	59192	110.00
8	59178	94.00	59193	114.00
10	59179	94.00	59194	114.00
15	59180	97.00	59195	117.00
20	59181	97.00	59196	117.00
30	59182	101.00	59197	122.00
45	59183	103.00	59198	123.00
60	59184	103.00	59199	123.00
80	59185	112.00	59351	132.00

† Two time limit attachments supplied.

†† Range of overload adjustment from normal rating to twice normal rating.

** For circuit breakers in capacities over 80 amperes refer to Bulletin No. 580.

In Ordering specify quantity, catalog number, whether A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.



Approximate overall dimensions Four Pole, Two Coil, and Four Pole, Four Coil, Type EAF Circuit Breakers.

Roller-Smith Enclosed Circuit Breakers Type EAF (Free Handle)

**80 Amperes and Less

250 Volts and Less D.C., 550 Volts and Less A.C.

*PLAIN UNDERVOLTAGE

Rated Ampere Capacity	250 VOLTS AND UNDER D.C., 550 VOLTS AND UNDER A.C.					
	Cat. No.	Two Pole	Cat. No.	Three Pole	Cat. No.	Four Pole
1/2	59352	\$45 .00	59367	\$67 .00	59382	\$78 .00
1	59353	45 .00	59368	67 .00	59383	78 .00
2	59354	45 .00	59369	67 .00	59384	78 .00
3	59355	45 .00	59370	67 .00	59385	78 .00
4	59356	45 .00	59371	67 .00	59386	78 .00
5	59357	45 .00	59372	67 .00	59387	78 .00
6	59358	45 .00	59373	67 .00	59388	78 .00
8	59359	45 .00	59374	71 .00	59389	82 .00
10	59360	45 .00	59375	71 .00	59390	82 .00
15	59361	45 .00	59376	74 .00	59391	85 .00
20	59362	45 .00	59377	74 .00	59392	85 .00
30	59363	45 .00	59378	78 .00	59393	89 .00
45	59364	48 .00	59379	80 .00	59394	91 .00
60	59365	50 .00	59380	80 .00	59395	91 .00
80	59366	52 .00	59381	89 .00	59396	100 .00

* One undervoltage attachment supplied.

** For circuit breakers in capacities over 80 amperes refer to Bulletin No. 580.

In Ordering specify quantity, catalog number, whether A.C. or D.C. and, if A.C., the frequency and number of phases and wires; exact operating voltage.

Supplement No. 1 to Bulletin No. 580 covers additional combinations of Type EAF Circuit Breakers. A copy of this Supplement will be supplied on request.

TYPE O OIL CIRCUIT BREAKERS
Indoor—*Non=Automatic—Single Throw
Manually Operated—Switchboard and Floor Mounting
TWO POLE

Class	Max. Amps. 60 Cycles	Max. Volts	†Switchboard Mounting			⊙Floor Mounting		
			Cat. No.	††Ship Wt.Lbs	List Price	Cat. No.	††Ship. Wt.Lbs	List Price
11	200	4500	6000	200	\$ 84.00	6051	275	\$117.00
11	400	4500	6001	210	118.00	6052	285	151.00
11	600	4500	6002	225	132.00	6053	300	165.00
12	400	7500	6003	225	128.00	6054	300	161.00
12	600	7500	6004	235	143.00	6055	310	176.00
12	800	7500	6005	245	181.00	6056	320	214.00
13	400	15000	6006	425	248.00	6057	525	291.50
13	600	15000	6007	440	270.00	6058	540	313.50
13	800	15000	6008	450	360.00	6059	550	403.50

THREE POLE

11	200	4500	6009	225	\$105.00	6060	300	\$138.00
11	400	4500	6010	240	145.00	6061	315	178.00
11	600	4500	6011	255	165.00	6062	330	198.00
12	400	7500	6012	255	155.00	6063	330	188.00
12	600	7500	6013	265	180.00	6064	340	213.00
12	800	7500	6014	275	230.00	6065	350	263.00
13	400	15000	6015	480	285.00	6066	580	328.50
13	600	15000	6016	500	300.00	6067	600	343.50
13	800	15000	6017	525	400.00	6068	625	443.50

FOUR POLE

11	200	4500	6042	290	\$132.00	6069	365	\$165.00
11	400	4500	6043	310	168.00	6070	385	201.00
11	600	4500	6044	330	201.00	6071	405	234.00
12	400	7500	6045	330	190.00	6072	405	223.00
12	600	7500	6046	350	224.00	6073	425	257.00
12	800	7500	6047	360	290.00	6074	435	323.00
13	400	15000	6048	625	385.00	6075	725	418.50
13	600	15000	6049	650	420.00	6076	750	463.50
13	800	15000	6050	680	540.00	6077	780	583.50

*Breakers are listed non-automatic. They are equipped with full automatic control without coils. Full automatic protection is secured by the addition of proper coils from the table of "Auxiliaries."

For current and potential transformer prices, see Page 8.

†The Roller-Smith Company does not recommend the installation of breakers directly on switchboards where the service voltage exceeds 2500 volts.

††Shipping Weight includes oil.

⊙Floor mounting consists of a switchboard mounting breaker mounted on a slate panel and assembled on pipe with floor braces. These breakers are complete and require no switchboard. Special prices will be quoted when provision is to be made for mounting current and potential transformers or instruments and relays.

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

Representatives in

Australia, Cuba, Japan and Philippine Islands

TYPE O OIL CIRCUIT BREAKERS
Indoor—*Non=Automatic—Single Throw
Hand Operated, Remote Control, Wall Mounting and
Electrically Operated, Cell Mounting
ONE POLE

Class	Max. Amps. 60 Cycles	Max. Volts	Remote Control Wall Mounting			Electrically Operated Cell Mounting		
			Cat. No.	††Ship. Wt. Lbs.	List Price	Cat. No.	††Ship. Wt. Lbs.	List Price
14	400	15000	6078	275	\$200.00	6118	375	\$375.00
14	600	15000	6079	300	208.00	6119	400	383.00
14	800	15000	6080	325	250.00	6120	425	425.00
15	400	15000	6081	300	250.00	6121	400	425.00
15	600	15000	6082	325	334.00	6122	425	509.00
15	800	15000	6083	350	375.00	6123	450	550.00

TWO POLE

11	200	4500	6018	225	\$109.00	—	—	—
11	400	4500	6019	235	143.00	—	—	—
11	600	4500	6020	250	157.00	—	—	—
12	400	7500	6021	250	153.00	6100	350	\$303.00
12	600	7500	6022	260	168.00	6101	360	318.00
12	800	7500	6023	280	206.00	6102	380	356.00
13	400	15000	6024	450	273.00	6103	550	423.00
13	600	15000	6025	465	295.00	6104	565	445.00
13	800	15000	6026	475	385.00	6105	575	535.00
13	1200	7500	6027	575	415.00	6106	675	590.00
13	1600	7500	6028	625	660.00	6107	725	835.00
13	2000	7500	6029	725	800.00	6108	825	975.00
14	400	15000	6084	550	350.00	6124	650	525.00
14	600	15000	6085	600	376.00	6125	700	551.00
14	800	15000	6086	650	415.00	6126	750	590.00
15	400	15000	6087	600	415.00	6127	700	590.00
15	600	15000	6088	655	500.00	6128	755	675.00
15	800	15000	6089	700	543.00	6129	800	718.00

THREE POLE

11	200	4500	6030	250	\$130.00	—	—	—
11	400	4500	6031	265	170.00	—	—	—
11	600	4500	6032	280	190.00	—	—	—
12	400	7500	6033	280	180.00	6109	380	\$330.00
12	600	7500	6034	290	205.00	6110	390	355.00
12	800	7500	6035	300	255.00	6111	400	405.00
13	400	15000	6036	505	310.00	6112	605	460.00
13	600	15000	6037	525	325.00	6113	625	475.00
13	800	15000	6038	550	425.00	6114	650	575.00
13	1200	7500	6039	650	480.00	6115	750	755.00
13	1600	7500	6040	700	825.00	6116	800	1125.00
13	2000	7500	6041	800	1100.00	6117	900	1400.00
14	400	15000	6090	825	500.00	6130	925	675.00
14	600	15000	6091	900	520.00	6131	1000	695.00
14	800	15000	6092	975	583.00	6132	1075	758.00
15	400	15000	6093	900	585.00	6133	1000	760.00
15	600	15000	6094	975	665.00	6134	1075	840.00
15	800	15000	6095	1050	750.00	6135	1150	925.00

FOUR POLE

11	200	4500	6096	315	\$157.00	—	—	—
11	400	4500	6097	335	183.00	—	—	—
11	600	4500	6098	355	226.00	—	—	—
12	400	7500	6099	355	215.00	6136	460	\$365.00
12	600	7500	6151	375	249.00	6137	475	400.00
12	800	7500	6152	385	315.00	6138	485	425.00
13	400	15000	6153	650	410.00	6139	750	560.00
13	600	15000	6154	675	445.00	6140	775	595.00
13	800	15000	6155	705	565.00	6141	800	715.00
13	1200	7500	6156	850	720.00	6142	950	905.00
13	1600	7500	6157	900	1050.00	6143	1000	1200.00
13	2000	7500	6158	1100	1450.00	6144	1200	1700.00
14	400	15000	6159	1100	650.00	6145	1200	825.00
14	600	15000	6160	1200	665.00	6146	1300	840.00
14	800	15000	6161	1300	750.00	6147	1400	925.00
15	400	15000	6162	1200	765.00	6148	1300	940.00
15	600	15000	6163	1300	835.00	6149	1400	1010.00
15	800	15000	6164	1400	955.00	6150	1500	1135.00

*Breakers are non-automatic. Both hand and solenoid mechanism are trip free. Automatic breakers are secured by adding proper coils, transformers and attachments from the table of Auxiliaries.
††Shipping Weight includes oil.
○Pipe mounting may be secured by adding two brackets (Cat. No. 6278) per breaker for classes 12 and 13 and two brackets per pole unit for classes 14 and 15 from list of Auxiliaries.

AUXILIARIES FOR OIL BREAKERS

Overload Coils for Making Breakers Automatic

Amps.	Max. voltage, 750 volts	Without Dash Pots		With Dash Pots	
	Connection	Cat. No.	List Price	Cat. No.	List Price
5	Series or Trans.	6200	\$10.00	6208	18.00 \$17.00
10	Series	6201	11.00	6209	18.00 18.00
25	Series	6202	11.00	6210	18.00 18.00
50	Series	6203	11.00	6211	18.00 18.00
75	Series	6204	11.00	6212	18.00 18.00
100	Series	6205	11.00	6213	18.00 18.00
150	Series	6206	11.00	6214	18.00 18.00
200	Series	6207	11.00	6215	18.00 18.00

SHUNT TRIP COILS

Volts	Catalog Numbers			List Price
	D. C.	60 Cycles	25 Cycles	
12	6220	6225	6230	\$10.00
24	6221	6226	6231	10.00
110	6222	6227	6232	10.00
220	6223	6228	6233	10.00
440	6224	6229	6234	10.00

UNDERVOLTAGE RELEASE ATTACHMENT

Volts	Catalog Numbers		List Price
	60 Cycles	25 Cycles	
110	6240	6243	\$30.00
220	6241	6244	30.00
440	6242	6245	30.00

UNDERVOLTAGE RELEASE WITH TIME DELAY

Volts	Catalog Numbers		List Price
	60 Cycles	25 Cycles	
110	6250	6253	\$65.00
220	6251	6254	65.00
440	6252	6255	65.00

UNDERVOLTAGE WITH LOCK OUT

Volts	Catalog Numbers		List Price
	60 Cycles	25 Cycles	
110	6260	6263	\$65.00
220	6261	6264	65.00
440	6262	6265	65.00

MISCELLANEOUS AUXILIARIES

Cat. No.		List Price
6275	Mechanical interlock for double throw service.....	\$7.00
6276	Common trip for double throw service.....	3.00
6277	Panel bracket.....	12.00
6278	Pipe mounting bracket for breakers (2 per breaker).....	ea. 3.00
6279	Auxiliary switch, single pole, double throw.....	18.00
6280	Bell alarm switch.....	3.50

MOTOR STARTING OIL CIRCUIT BREAKERS

For 3-phase Synchronous Motors—Auto-transformer Starting

No. Cat.	Run.		Start.		Mag.		MAX. H. P. MOTOR VOLTS					List Price
	Class	Amps	Class	Amps	Class	Amps	220	440	2200	4000	6600	
6300	C-11	200	C-11	200	C-11	200	80	160	400	500	—	\$445.00
6301	C-11	400	C-11	200	C-11	200	160	320	800	1000	—	485.00
6302	C-11	600	C-11	200	C-11	200	250	500	1000	—	—	505.00
6303	C-12	800	C-11	200	C-11	200	325	650	2000	—	—	570.00
6304	C-12	400	C-12	400	C-12	400	—	—	—	—	2000	595.00

MOTOR STARTING OIL CIRCUIT BREAKERS
For 3-phase Synchronous Motors—One Step Reactance Starting
Reactors Included

220 VOLTS

H. P. 80% P. F.	H. P. Unity P. F.	25 CYCLES		60 CYCLES	
		Cat. No.	List Price	Cat. No.	List Price
100	125	6310	\$612.00	6316	\$537.00
125	160	6311	637.00	6317	557.00
150	190	6312	672.00	6318	582.00
200	250	6313	740.00	6319	628.00
250	315	6314	785.00	6320	655.00
300	385	6315	905.00	6321	775.00

440 VOLTS

H. P. 80% P. F.	H. P. Unity P. F.	25 CYCLES		60 CYCLES	
		Cat. No.	List Price	Cat. No.	List Price
100	125	6322	\$570.00	6328	\$495.00
125	160	6323	595.00	6329	515.00
150	190	6324	630.00	6330	540.00
200	250	6325	722.00	6331	610.00
250	315	6326	767.00	6332	637.00
300	385	6327	807.00	6333	677.00

2200 VOLTS

H. P. 80% P. F.	H. P. Unity P. F.	25 CYCLES		60 CYCLES	
		Cat. No.	List Price	Cat. No.	List Price
100	125	6334	\$595.00	6340	\$512.00
125	160	6335	620.00	6341	544.00
150	190	6336	665.00	6342	562.00
200	250	6337	718.00	6343	595.00
250	315	6338	765.00	6344	625.00
300	385	6339	810.00	6345	668.00

Mounting Panels and Mounting Structures for Classes 11, 12, and 13 Breakers

DESCRIPTION	SLATE			Cat. No.	List Price
	Height	Width	Thickness		
Slate panel only (drilled).....	18	16	1 1/2	6375	\$15.00
" " " "	18	24	1 1/2	6376	18.50
" " " "	18	16	1 1/2	6377	18.50
" " " "	18	24	2	6378	21.50
Slate Panel with Pipe Frame and Braces.....	18	16	1 1/2	6379	\$33.00
" " " " " " "	18	24	1 1/2	6380	40.00
" " " " " " "	18	16	2	6371	40.00
" " " " " " "	18	24	2	6382	43.50

When ordered with breakers, drilling includes all breaker attachments.
Class 11 and 12 switchboard mounting breakers will go on 16" wide slate.
Class 13 breakers up to and including 800 amperes will go on 24" wide slate, 2" thick.
For Class 13 breakers over 800 amperes, add \$15.00 list to the list prices of Cat. Nos. 6379, 6380, 6381 and 6382. The resulting figure should be added to the "remote control wall mounting" price on page 2. This forms a "floor mounting" combination.
Price and technical information on Mounting Panels and Mounting Structures on Classes 14 and 15 breakers on application.
When desired to mount relays or instruments on panels with the breakers larger panels will be supplied on request at an extra charge.

INSTRUCTIONS FOR ORDERING

Manually operated, switchboard mounting catalog numbers include breaker unit, hand operating device, adjustable connection between breaker unit and hand operating device and mounting bolts for use on either 1½ or 2" panel. No panel, trip coils, current transformers or attachments are included. The hand operating device is full automatic or trip free but without coils. To secure an automatic breaker it is necessary to add the proper number and kind of trip coils from the list of auxiliaries and the current and potential transformers if required. See Fig. 1, Page 7.

Manually operated floor mounting catalog numbers include a switchboard mounting breaker mounted on a slate panel with pipe frame and floor braces. They are a complete unit that may be bolted to the floor, no switchboard being required. They are full automatic but without trip coils, current transformers or attachments. Automatic breakers are secured by adding the proper number and kind of trip coils current transformers and attachments from the list of auxiliaries. See Fig. 2, Page 7.

Manually operated, remote control wall mounting catalog numbers include breaker unit for bolting to wall or flat surface, two bell cranks and hand operating device for mounting on either 1½ or 2" panel. Mounting bolts are supplied for the hand operating device but not for bell crank or breaker unit. Operating rods are ¾" pipe supplied by customer. They are full automatic but without trip coils, current transformers or attachments. Automatic breakers are secured by adding the proper trip coils, transformers and attachments from the list of auxiliaries. See Fig. 3, Page 7.

Electrically operated catalog numbers include breaker unit and D.C. solenoid mechanism arranged for mounting back to back on opposite sides of cell wall or on frame work. The solenoid mechanism includes closing coil, D.C. shunt trip coil, single stage auxiliary switch with one circuit opening and one circuit closing contact and a terminal board to which all leads are brought. The mechanism is full automatic or mechanically trip free. Provision is made for three additional trip coils which may be shunt trip or transformer trip coils. These should be ordered when required from the list of auxiliaries. See Fig. 4, Page 7.

METHODS OF TRIPPING

Up to 200 amperes and 750 volts series trip coils may be used. Above these values 5 ampere transformer trip coils and current transformers are available.

The number of trip coils usually required are as follows:

2-pole breaker on single phase circuit.....	1 overload trip
3-pole breaker on 2-phase, 3-wire system.....	2 overload trip
3-pole breaker on 3-phase, 3-wire ungrounded....	2 overload trip
3-pole breaker on 3-phase, 3-wire grounded.....	3 overload trip
3-pole breaker on 3-phase, 4-wire system.....	3 overload trip
4-pole breaker on 2-phase, 4-wire system.....	2 overload trip

Under-voltages may be connected directly across the line up to 550 volts. For higher voltages order proper potential transformer.

Example: There is required an automatic switch for a feeder whose load is a motor drawing 100 amperes at 220 volts, 3-phase. A switchboard panel will be provided by customer.

Supply: 1—Class C-11, 200 amperes, 4500 volt, 3-pole, single throw, Cat. No. 6009.

2—100 amperes, series trip coils with dash pots, Cat. No. 6213.

Example: A 3-pole, 600 ampere switch is required for 2200 volt service having interrupting capacity of 10,000 amperes at service voltage. It is to be equipped with time delay overload and time delay undervoltage. It is to be mounted on pipe structure remote from the switchboard.

By reference to the table of interrupting capacities it is found that the Class 13 breaker has the required interrupting capacity:

Supply: 1—Class C-13, 3-pole, single throw, 15,000 volt breaker, Cat. No. 6037.

2—Pipe brackets, Cat. No. 6278.

2—5 ampere, trip coils for transformer operation, with dash pots, Cat. No. 6208.

1—Undervoltage with time delay, 110 volts, 60 cycles, Cat. No. 6250.

2—Current transformers, 600/5 amperes, Cat. No. 6925.

1—Potential transformer, 2200/110 volts, 60 cycles, Cat. No. 6469.

RATINGS OF TYPE O OIL CIRCUIT BREAKERS

Breaker Rating			Current Capacity for		Interrupting Capacity in RMS Amps. at Various Voltages						
Class	Amps.	Volts	1=Sec.	5=Sec.	750	2500	4500	6000	7500	12000	15000
11	200	4500	20000	10000	18750	5100	2500				
11	400	4500	40000	20000	18750	5100	2500				
11	600	4500	60000	30000	18750	5100	2500				
12	400	7500	40000	20000	24000	7200	3750	2650	2000		
12	600	7500	60000	30000	24000	7200	3750	2650	2000		
12	800	7500	80000	40000	24000	7200	3750	2650	2000		
13	400	15000	40000	20000	38600	11500	6250	4500	3500	2000	1500
13	600	15000	60000	30000	38600	11500	6200	4500	3500	2000	1500
13	800	15000	80000	40000	38600	11500	6200	4500	3500	2000	1500
13	1200	7500	100000	60000	38600	11500	6200	4500	3500	—	—
13	1600	7500	100000	80000	38600	11500	6200	4500	3500	—	—
13	2000	7500	100000	100000	38600	11500	6200	4500	3500	—	—
14	400	15000	40000	20000	40000	19000	10180	7400	5800	3300	2500
14	600	15000	60000	30000	60000	19000	10200	7400	5800	3300	2500
14	800	15000	80000	40000	64000	19000	10200	7400	5800	3300	2500
15	400	15000	40000	20000	40000	26200	14100	10400	8100	4600	3500
15	600	15000	60000	30000	60000	26200	14100	10400	8100	4600	3500
15	800	15000	80000	40000	80000	26200	14100	10400	8100	4600	3500

To obtain interrupting capacity at any voltage use the following equation:

$$I = \frac{A \times B}{E} \left[1 + \left(1 - \frac{E}{A} \right) 0.3 \right]$$

where A—max. voltage rating listed in table.

B—current rating at A voltage.

E—desired voltage.

I—desired current rating at voltage E.

NOTE No. 1—For voltages less than 750 volts use the 750 volt rating.

NOTE No. 2—Breakers equipped with series trip coils will be limited in carrying capacity to 25 times coil rating for 1 sec. and 50 times for 5 sec. and in interrupting capacity to the 1 sec. rating of the coil.

*STYLES OF MOUNTING OF TYPE O OIL CIRCUIT BREAKERS

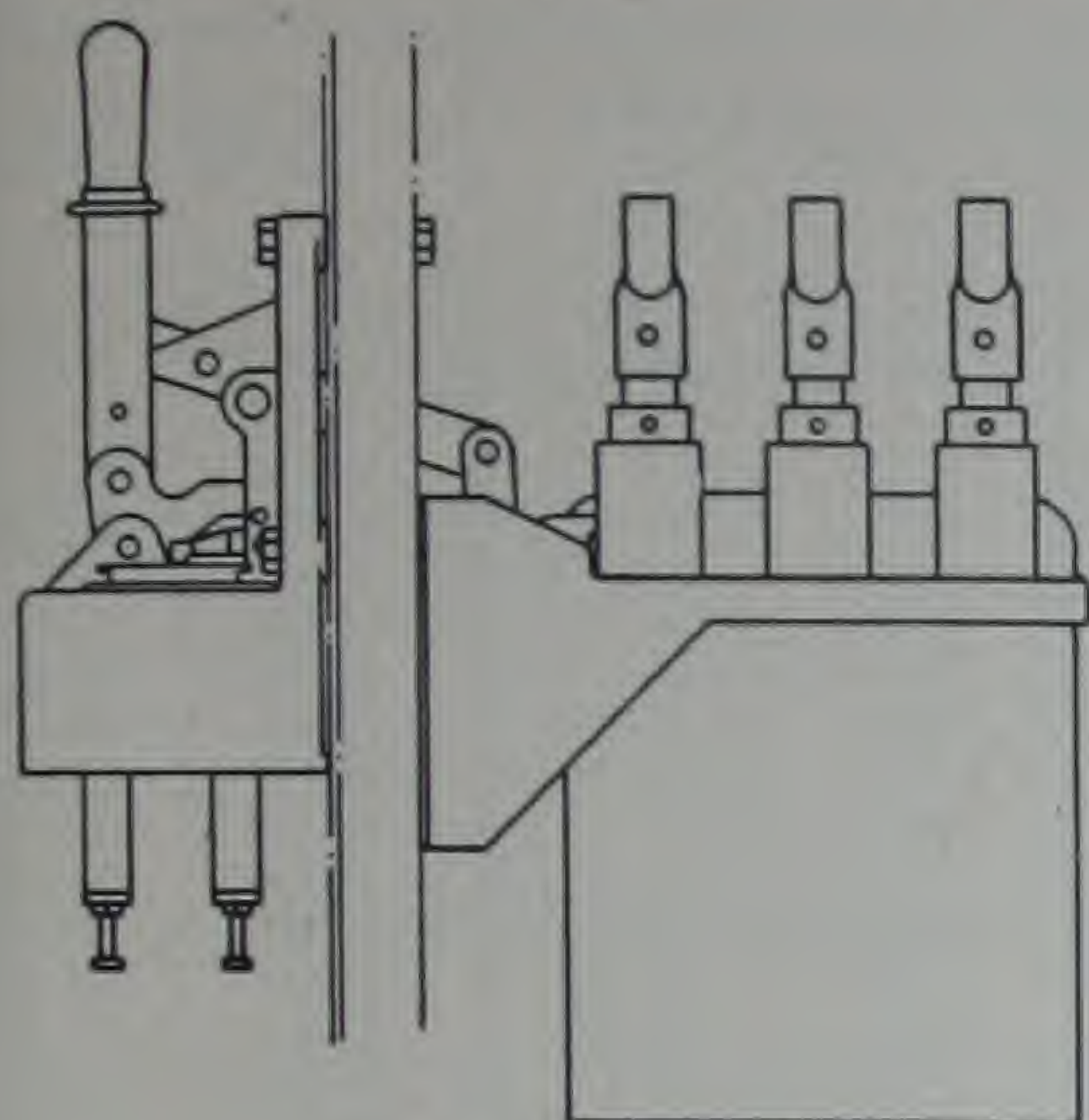


Fig. 1. Switchboard Mounting

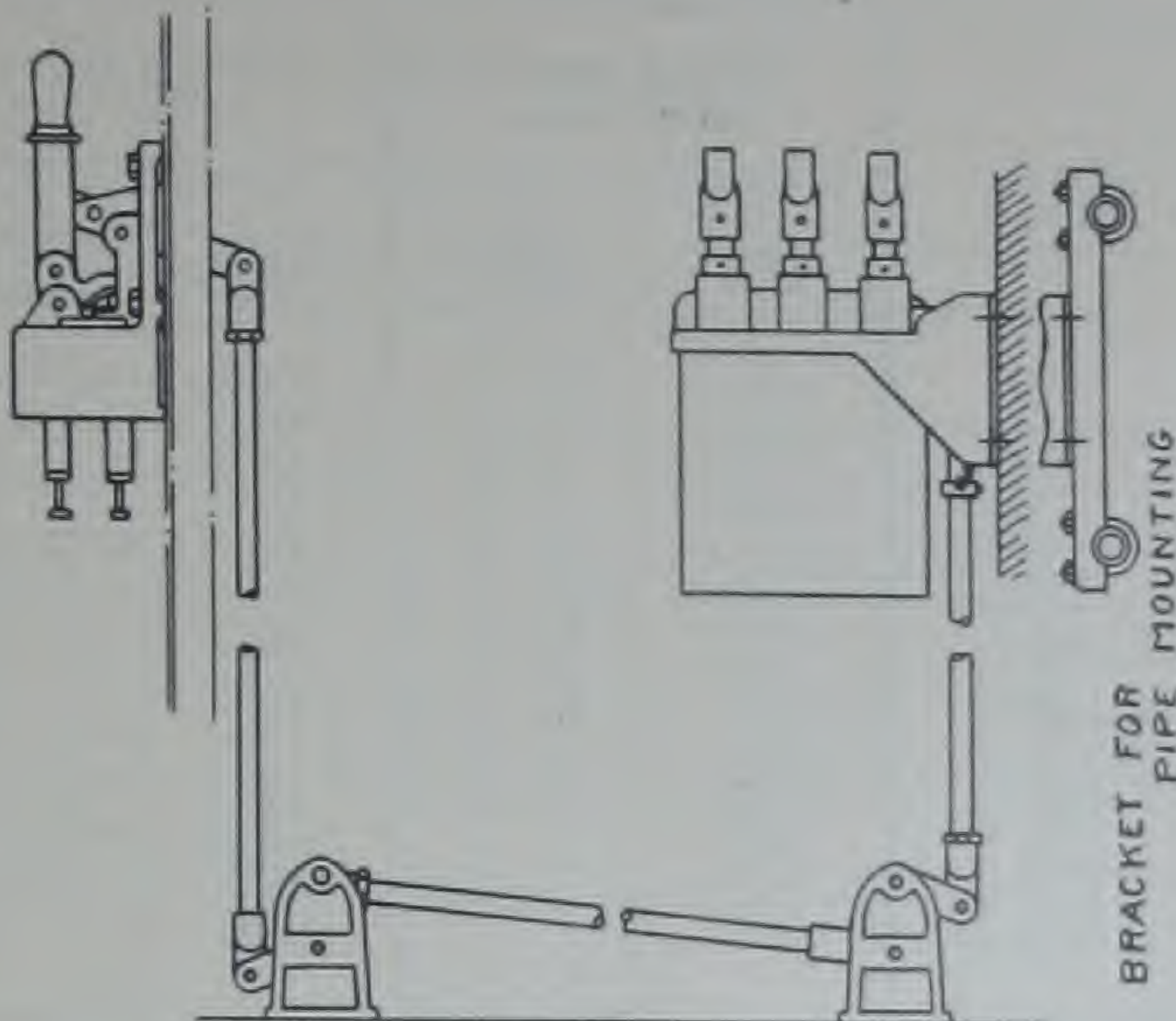


Fig. 3. Wall Mounting

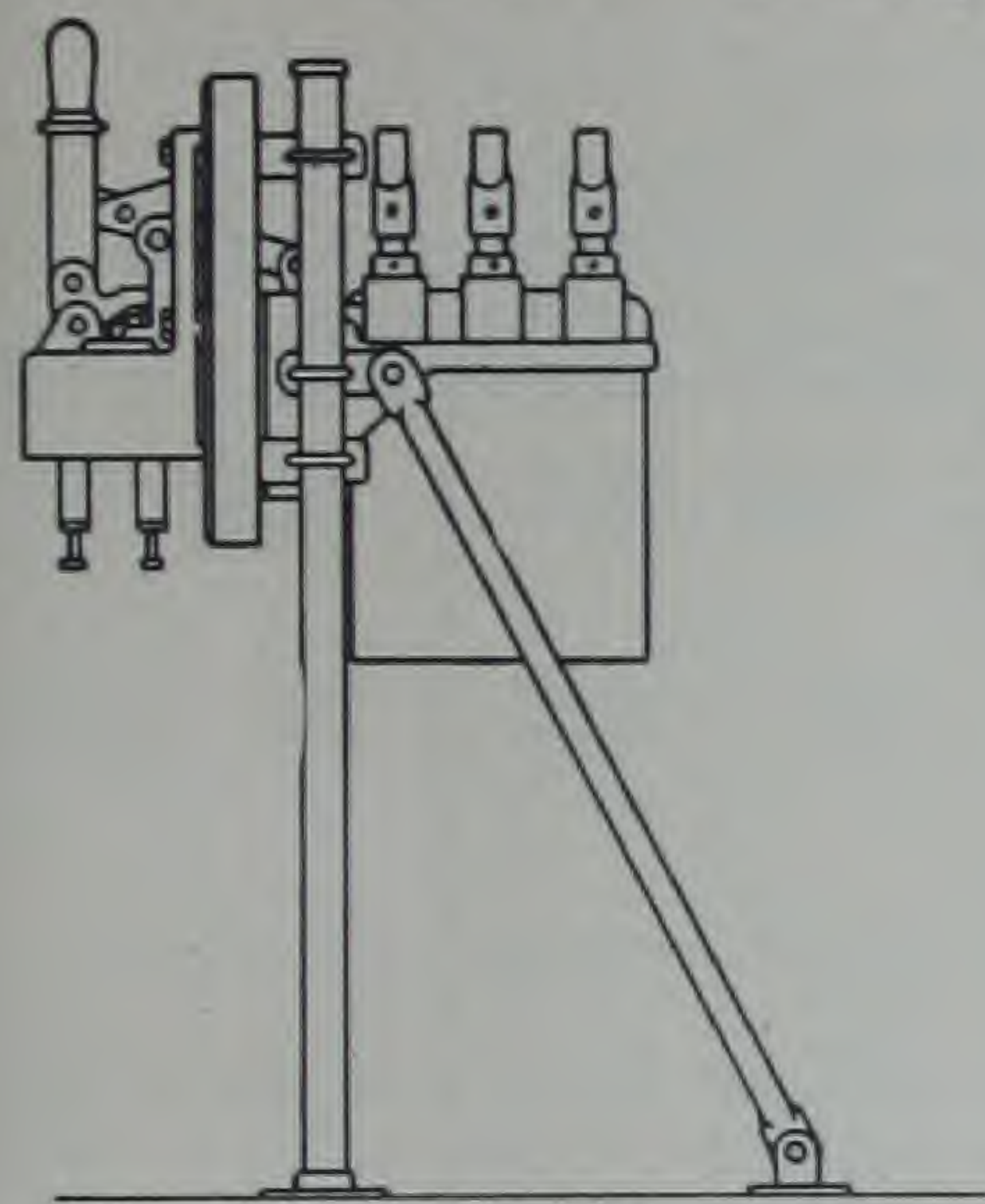


Fig. 2. Floor Mounting

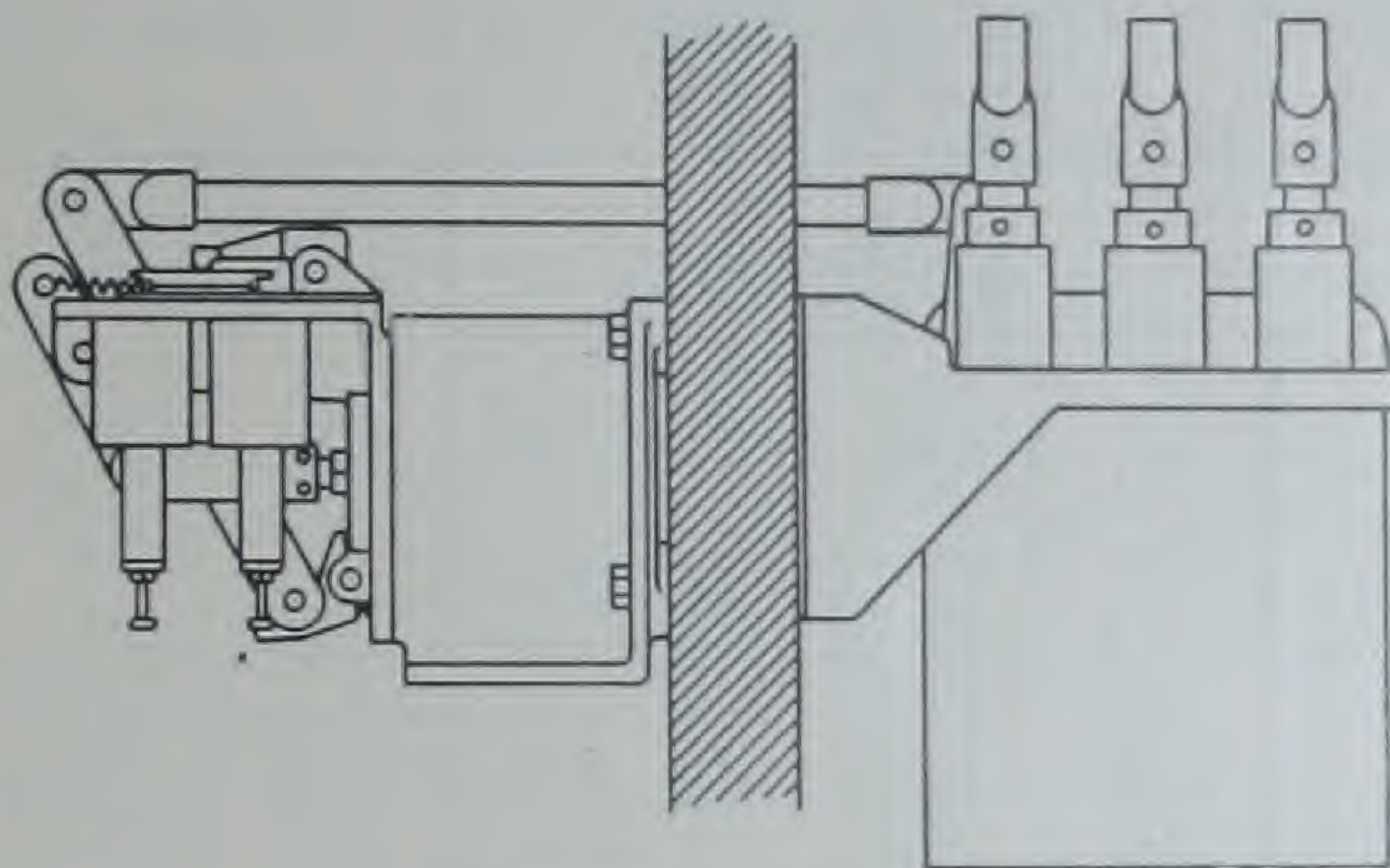
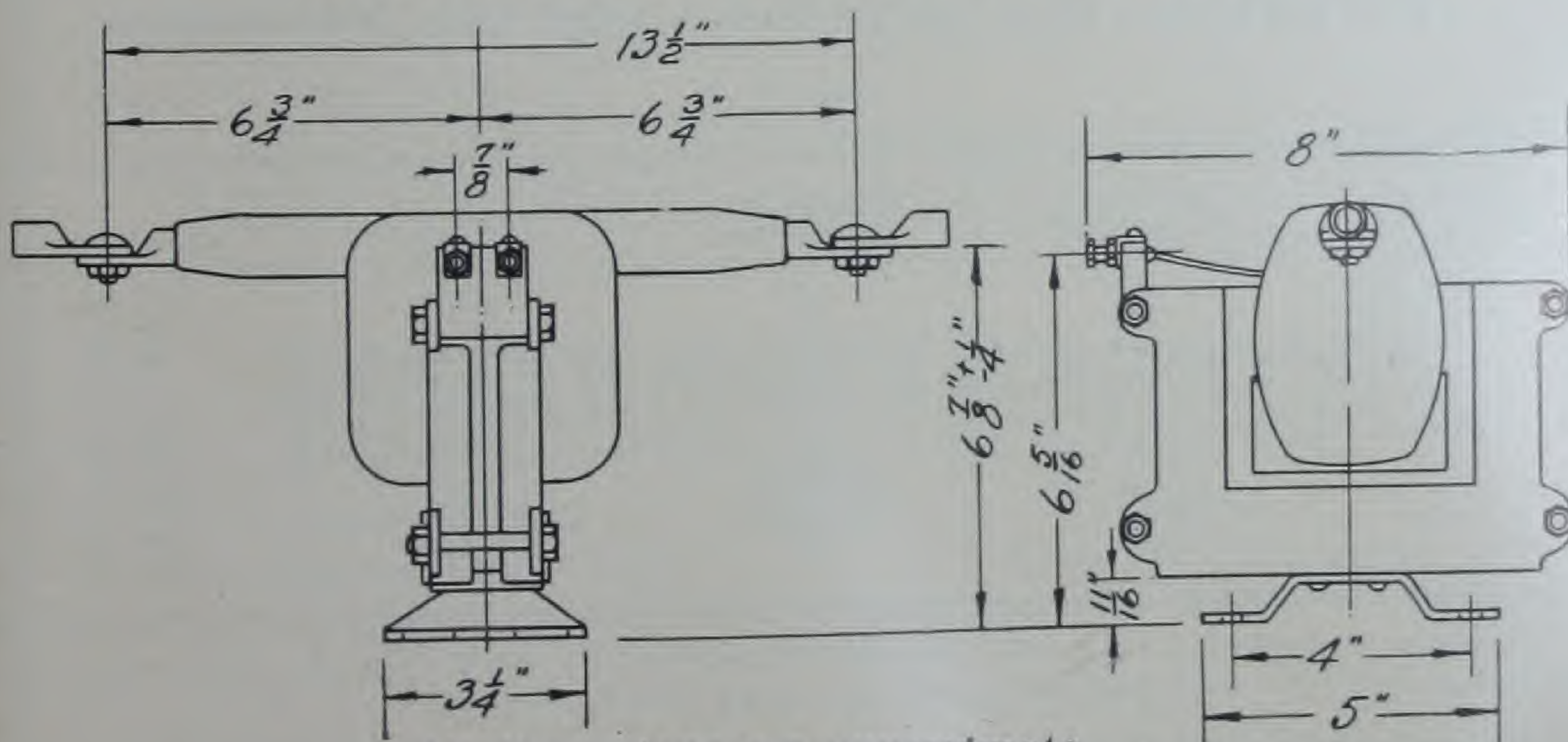


Fig. 4. Electrically Operated

*See Page 5 for text matter pertaining to these styles of mounting

DIMENSIONS OF TYPE LK CURRENT TRANSFORMERS



All dimensions are approximate

*CURRENT TRANSFORMERS FOR OIL BREAKERS

WOUND PRIMARY

Ratio Amps.	TYPE LK 7500 Volts		TYPE K-1 4500 Volts		TYPE K-2 7500 Volts		TYPE K-3 15000 Volts	
	Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price
5/5	6400	\$24.00	6412	\$31.25	6426	\$46.75	6440	\$62.75
10/5	6401	24.00	6413	31.25	6427	46.75	6441	62.75
15/5	6402	24.00	6414	31.25	6428	46.75	6442	62.75
25/5	6403	24.00	6415	31.25	6429	46.75	6443	62.75
50/5	6404	24.00	6416	31.25	6430	46.75	6444	62.75
75/5	6405	24.00	6417	31.25	6431	46.75	6445	62.75
100/5	6406	24.00	6418	31.25	6432	46.75	6446	62.75
150/5	6407	25.00	6419	32.25	6433	47.75	6447	65.50
200/5	6408	26.00	6420	34.00	6434	49.50	6448	67.50
250/5	6409	26.50	6421	35.00	6435	50.25	6449	68.25
300/5	6410	27.00	6422	37.00	6436	52.00	6450	69.25
400/5	6411	27.75	6423	38.75	6437	53.00	6451	71.00
500/5	6479	31.00	6424	40.25	6438	53.75	6452	72.00
600/5	—	—	6425	44.00	6439	55.50	6453	73.00

Ratio Amps.	**OPEN PRIMARY NO BUS BAR FURNISHED			OPEN PRIMARY ONE TURN PRIMARY BUS BAR BUS BAR FURNISHED					
	TYPE BK 4500 VOLTS			TYPE BK-1 4500 Volts		TYPE BK-2 7500 Volts		TYPE BK-3 15000 Volts	
	Cat. No.	List Price	Opening Dimensions	Cat. No.	List Price	Cat. No.	List Price	Cat. No.	List Price
400/5	6483	\$24.50	3/4" x 2 1/4"	—	—	—	—	—	—
500/5	6484	24.50	3/4" x 2 1/4"	—	—	—	—	—	—
600/5	6485	24.50	3/4" x 2 1/4"	6480	\$45.00	6481	\$58.50	6482	\$74.75
750/5	6486	24.50	3/4" x 2 1/4"	6454	47.50	6459	61.25	6464	77.00
1000/5	6487	27.00	1" x 3 1/4"	6455	50.25	6460	66.75	6465	81.00
1250/5	6488	27.00	1" x 3 1/4"	6456	59.25	6461	77.25	6466	90.00
1500/5	6489	27.00	1" x 3 1/4"	6457	59.25	6462	77.25	6467	90.00
2000/5	6490	31.50	1 1/4" x 3 1/4"	6458	63.75	6463	88.00	6468	101.75

*The Type LK current transformers are for tripping oil circuit breakers and actuating relays. Indicating instruments may, however, be used with them. All other transformers are 50 V.A.

**No bus bar furnished. Units usually supported by primary bus bar. Add \$9.75 list for separate supports for clamping to panel.

POTENTIAL TRANSFORMERS FOR OIL BREAKERS

200 V. A.

Type PS Ratio Volts	Type PD Ratio Volts	Frequency in Cycles	Cat. No.	List Price
†2200/110	—	60	6469	\$37.00
†2200/110	—	25	6470	52.00
4400/110	—	60	6471	56.50
4400/110	—	25	6472	67.50
6600/110	—	60	6473	73.75
6600/110	—	25	6474	86.25
—	11000/110	60	6475	125.50
—	11000/110	25	6476	174.00
—	13200/110	60	6477	134.50
—	13200/110	25	6478	192.50

†Potential transformers, ratio 2200/110 volts can be supplied with 2 fuses mounted on the transformer at \$10.00 list extra per transformer.

TYPE O OIL CIRCUIT BREAKERS
Indoor—*Non=Automatic—Single Throw

Manually Operated—Switchboard and Floor Mounting
TWO POLE

Class	Max. Amps. 60 Cycles	Max. Volts	†Switchboard Mounting			⊙Floor Mounting		
			Cat. No.	††Ship. Wt. Lbs.	List Price	Cat. No.	††Ship. Wt. Lbs.	List Price
10	200	4500	6171	150	\$78.00	6165	225	\$108.00
10	400	4500	6172	160	88.00	6166	235	118.00

THREE POLE

10	200	4500	6173	160	\$98.00	6167	235	\$128.00
10	400	4500	6174	175	105.00	6168	250	135.00

FOUR POLE

10	200	4500	6175	210	\$122.00	6169	285	\$152.00
10	400	4500	6176	225	129.00	6170	300	159.00

Hand Operated—Remote Control—Wall Mounting
TWO POLE

Class	Max. Amps. 60 Cycles	Max. Volts	⊕ Remote Control Wall Mounting		
			Cat. No.	††Ship. Wt. Lbs.	List Price
10	200	4500	6177	175	\$103.00
10	400	4500	6178	185	113.00

THREE POLE

10	200	4500	6179	185	\$123.00
10	400	4500	6180	200	130.00

FOUR POLE

10	200	4500	6181	235	\$147.00
10	400	4500	6182	250	154.00

*Breakers are listed non-automatic. They are equipped with full automatic control **without coils**. Full automatic protection is secured by the addition of proper coils from the table of "Auxiliaries."

For current and potential transformer prices, see Page 8 of Price Sheet No. 2 for Bulletin No. 600.

†The Roller-Smith Company does not recommend the installation of breakers directly on switchboards where the service voltage exceeds 2500 volts.

††Shipping Weight includes oil.

⊙ Floor mounting consists of a switchboard mounting breaker mounted on a slate panel and assembled on pipe with floor braces. These breakers are complete and require no switchboard. Special prices will be quoted when provision is to be made for mounting current and potential transformers or instruments and relays.

⊕ Pipe mounting may be secured by adding two brackets (Cat. No. 6278) per breaker.

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

Representatives in

Australia, Cuba, Japan and Philippine Islands

MOTOR STARTING OIL CIRCUIT BREAKERS

For 3-phase Synchronous Motors

Auto-transformer Starting

Cat. No.	RUN.		START.		MAG.		MAX. H. P. MOTOR VOLTS					List Price
	Class	Amps	Class	Amps	Class	Amps	220	440	2200	4000	6600	
6305	10	200	10	200	10	200	80	160	400			\$408.00
6306	10	400	10	200	10	200	160	320	800			415.00

RATINGS OF TYPE O OIL CIRCUIT BREAKERS

BREAKER RATING			CURRENT CAPACITY FOR		INTERRUPTING CAPACITY IN RMS AMPS. AT VARIOUS VOLTAGES						
Class	Amps	Volts	1-Sec.	5-Sec.	750	2500	4500	6000	7500	12000	15000
10	200	4500	20000	10000	11300	3100	1500				
10	400	4500	40000	20000	11300	3100	1500				

AUXILIARIES FOR OIL BREAKERS

Refer to Price Sheet No. 2 for Bulletin No. 600 for prices on overload coils, shunt trip coils, under-voltage release attachments and miscellaneous auxiliaries; also for instructions for ordering, styles of mounting, transformer prices and data on oil breakers in sizes larger than the Class 10.



RELAYS

BULLETIN No. 550

APRIL, 1930

(Superseding issue dated
February, 1928)



RELAYS

TYPE SR

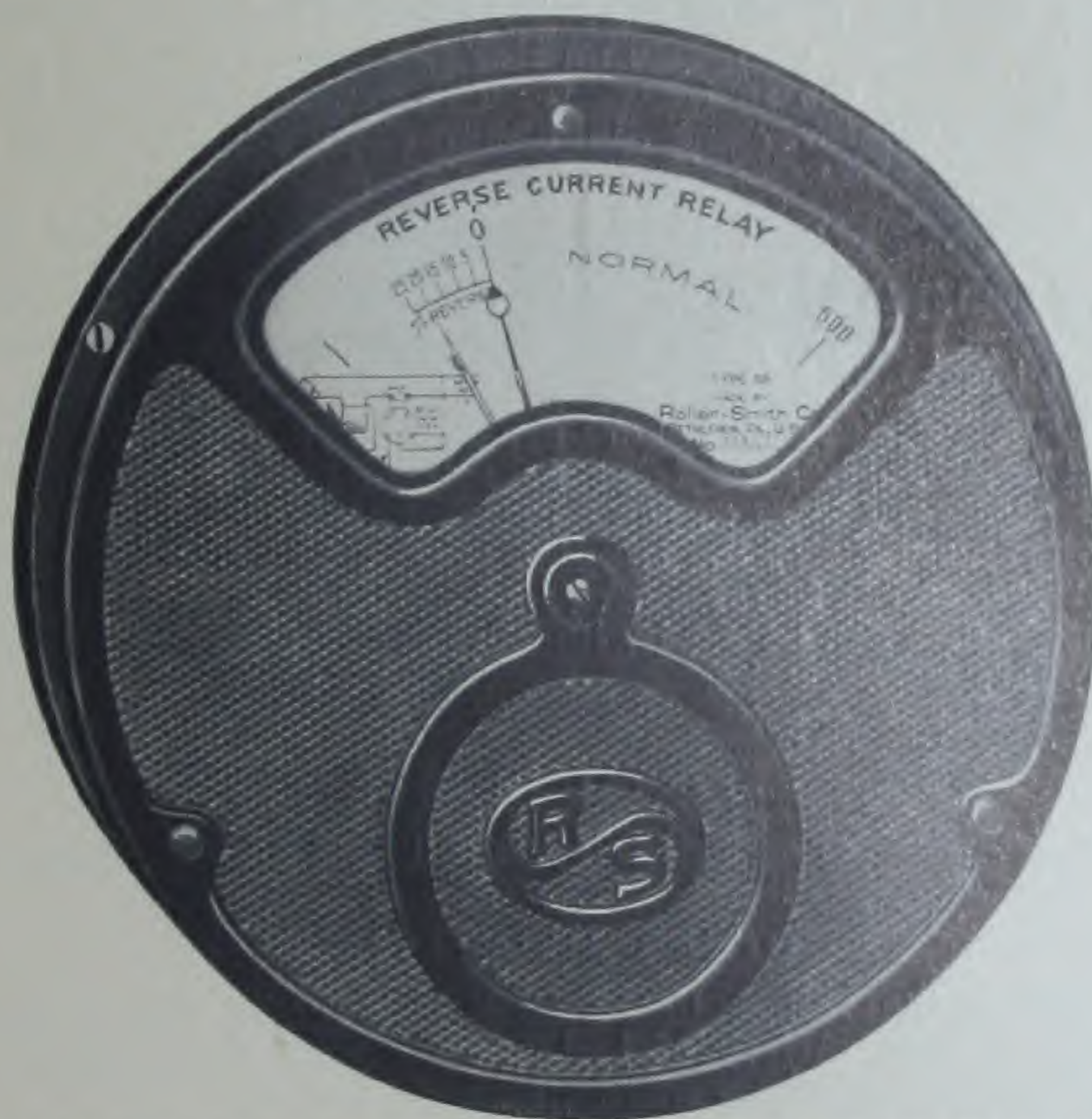
REVERSE CURRENT, OVERLOAD, UNDERLOAD
OVER-VOLTAGE AND UNDER-VOLTAGE

TYPE AB

TIME LIMIT

TYPE FR

FOR AUXILIARY SERVICE



TYPE SR REVERSE CURRENT RELAY (7½" DIAMETER)

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



WORKS:
Bethlehem, Pennsylvania

*Offices in Principal Cities in United States and Canada
Representatives in Australia, Cuba, Japan and Philippine Islands*

RELAYS

INTRODUCTORY

This new Bulletin covers all ROLLER-SMITH direct and alternating current relays.

TYPE SR RELAYS

GENERAL

ROLLER-SMITH relays are the product of many years' experience in building high grade measuring instruments and circuit breakers. The Type SR relays differ from all other types of relays in that regular instrument mechanisms are used for operating the self-contained circuit opening or closing switch, thus giving a much higher degree of accuracy and a much wider range of adjustment than heretofore obtainable.

CONSTRUCTION OF TYPE SR RELAYS

An instrument mechanism has a platinum spring contact attached to its pointer, which contact co-operates with a similar one carried by an externally adjustable pilot needle. The pilot needle is set by means of a slotted-head button, projecting from the front of the relay case. The circuit established on engagement of the contacts energizes an electro-magnet which is mounted below on the same base with the instrument. The switch operated by the electro-magnet then effects whatever external circuit change the relay is designed for.

USE IN CONJUNCTION WITH ROLLER-SMITH CIRCUIT BREAKERS

These various types of relays, while very useful for many special applications, are designed primarily for use with our under-voltage and shunt trip types of circuit breakers.

ROLLER-SMITH circuit breakers are regularly furnished with practically all styles and combinations of trips as self-contained devices, but in some instances it is necessary to have some means of securing a closer setting or a wider range of adjustment of the tripping points than is afforded by our standard types of trips, and it is for such requirements that our relays are recommended. These relays can be used with all ampere capacity breakers from the smallest to the largest we make.

SPECIAL RELAYS

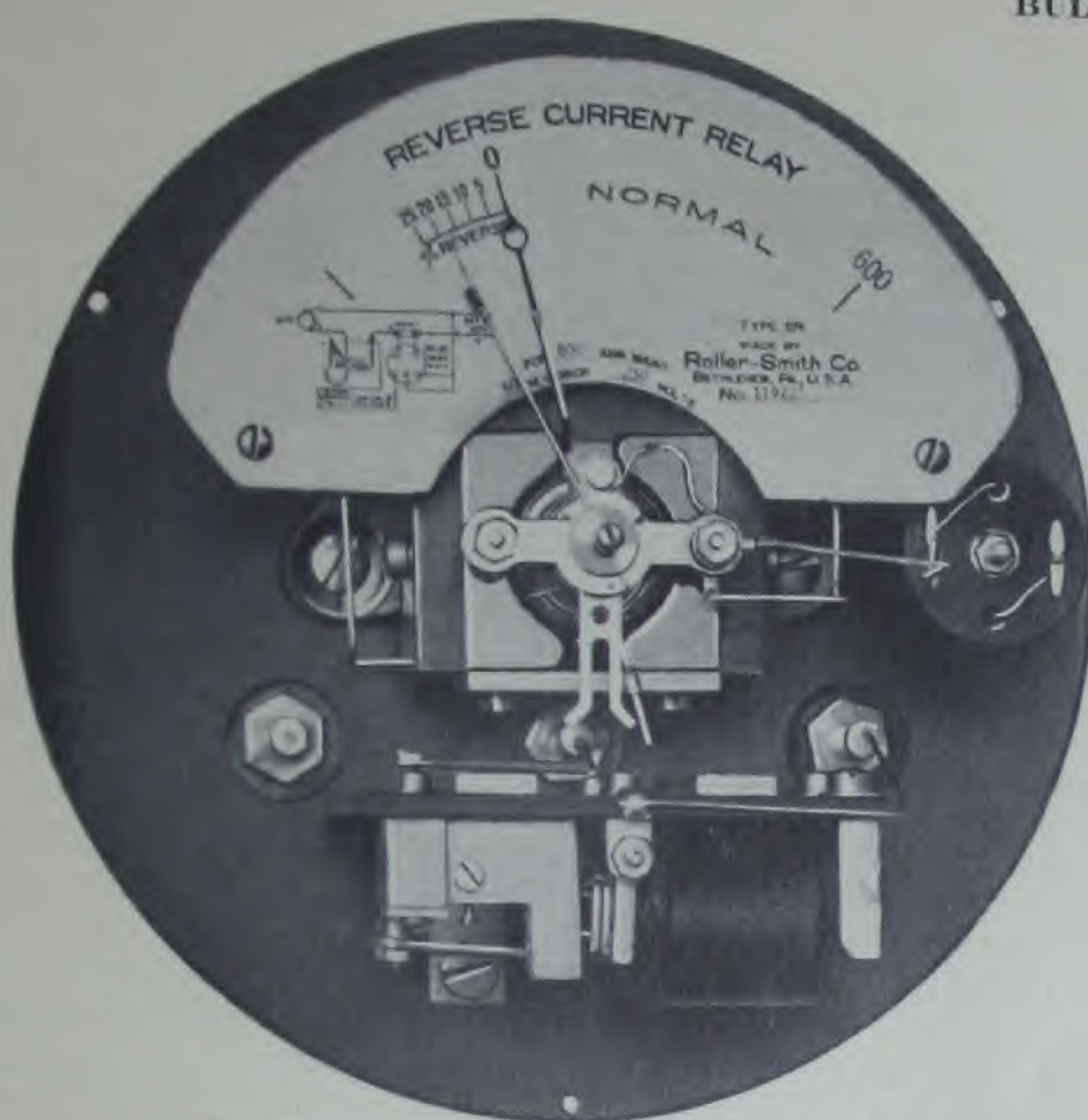
We invite inquiries for special relays not listed in these pages.

OTHER APPARATUS

In addition to the relays listed in this Bulletin the ROLLER-SMITH Company makes a wide variety of instruments and circuit breakers. A complete list of all our publications will be sent on request.

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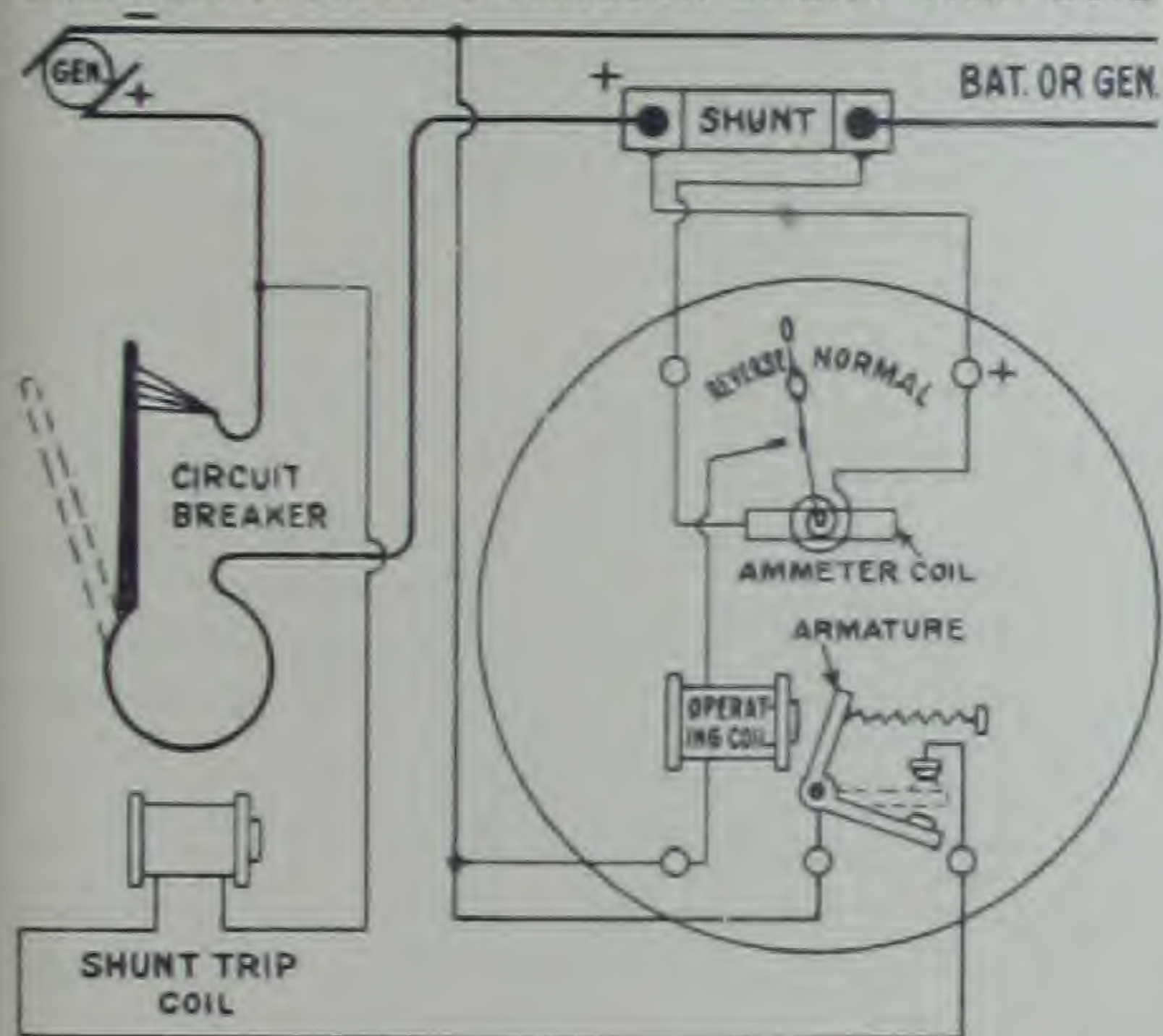
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Type SR Reverse Current Relay with Cover Off

TYPE SR REVERSE CURRENT RELAYS

CONNECTIONS OF REVERSE CURRENT RELAY AND CIRCUIT BREAKER OPERATED THROUGH SHUNT TRIP COIL



While suitable for many purposes where it is desired to bring about a circuit change when a reversal of current takes place, these reverse current relays are designed especially for use in connection with our shunt trip type circuit breakers (Bulletin No. 530). By connecting the instrument to an appropriate shunt so that for normal direction of current flow the pointer deflects up the scale, the main circuit remains closed until a reverse current flow occurs, whereupon the pointer moves down the scale, the shunt trip coil is energized and the circuit breaker instantly opened.

The apparatus necessary to provide reverse current protection for battery charging, for generators operating in parallel and for other applications, such,

for instance, as certain electrolytic processes would usually be a shunt trip circuit breaker with a reverse current relay and a shunt.

The ampere capacity of the shunt with which the relay is to be used is shown at the extreme right end of the scale. The zero mark is about one-third up the scale. The phrase "% reverse" occupies part of the scale to the left of zero and the phrase "normal" occupies the two-thirds of the scale to the right of zero. The ampere value corresponding to one-half of the capacity of the shunt is the mark at the extreme left end of the scale. The pilot needle is located to the left of the pointer and is adjustable from 5% to 25% reverse current. With current flowing in the proper direction the pointer moves up the scale. On a reversal of current the pointer moves down the scale and makes contact with the pilot needle when it reaches the point at which the pilot needle is set.

Cat. No.	Description	List Price
55000	Reverse Current Relay and leads, scale to suit shunt; with back connection studs	\$56.00

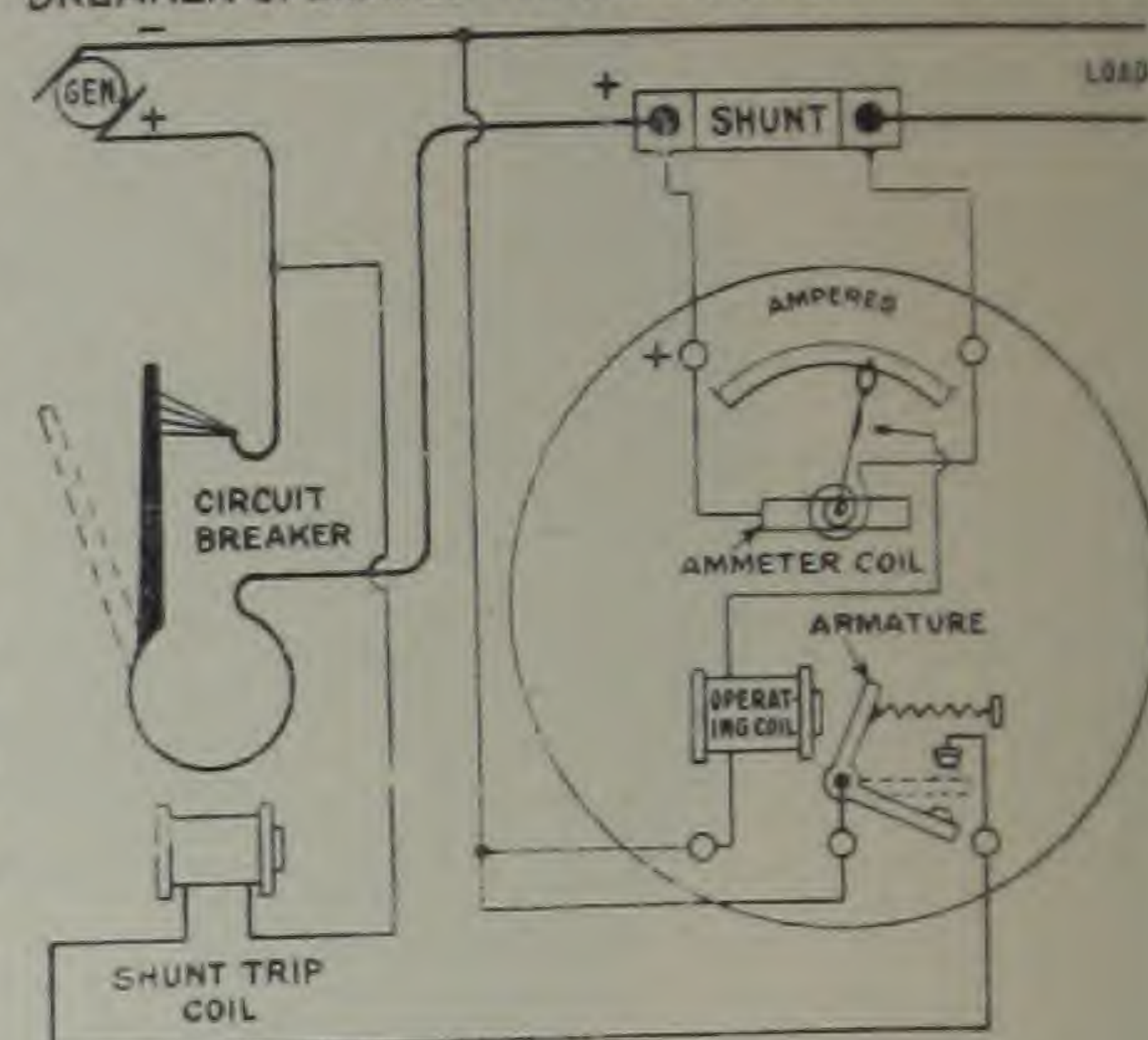
In ordering specify quantity, catalog number, exact operating voltage and ampere capacity of shunt with which relay is to be used. The milli-volt drop of the shunt should be given also when relays are ordered for use with shunts other than ROLLER-SMITH. See page 5 for listing of shunts.

TYPE SR OVERLOAD RELAYS

This is exactly the same as our reverse current relay in that the overload relay has the instrument element so connected that increase of load current causes the pointer to move **up** the scale but toward instead of away from the pilot needle. The overload relay may be used to operate a signal or alarm and may be used also in connection with our shunt trip circuit breaker in cases where it is desired to have the circuit breaker trip at some point **above** or **below** the lowest value at which the overload feature can normally be set.

Take, for an example of the former, a case where the normal load varies widely from time to time and it is necessary to change the overload tripping point of the circuit breaker to correspond. Our "Standard" circuit breaker has a range of adjustment of 100% to 200% or normal rating and obviously this would not take care of the requirement if it were necessary to set the tripping point **below** the normal rating of the breaker. We would, in that case, recommend the use of a shunt trip type circuit breaker, complete with an overload relay and shunt, the ampere capacity of the latter being approximately the maximum tripping value involved. The overload tripping point could then be made **anything from zero to 100% of the shunt rating.**

CONNECTIONS OF OVERLOAD RELAY AND CIRCUIT BREAKER OPERATED THROUGH SHUNT TRIP COIL

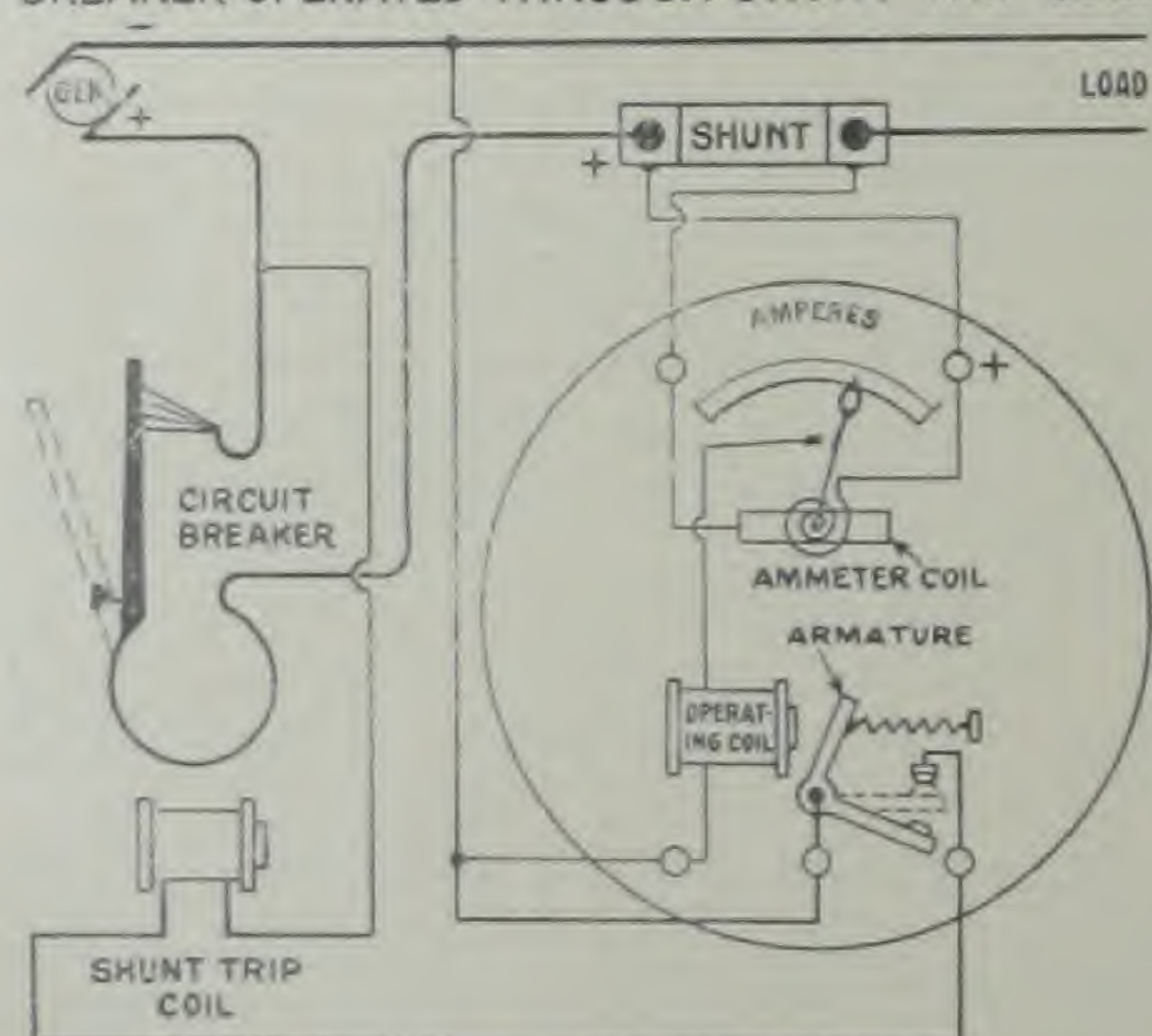


Cat. No.	Description	List Price
55002	Overload Relay and leads, scale to suit shunt; with back connection studs	\$56.00

In ordering specify quantity, catalog number, exact operating voltage and ampere capacity of shunt with which relay is to be used. The milli-volt drop of the shunt should be given also when relays are ordered for use with shunts other than ROLLER-SMITH. See page 5 for listing of shunts.

TYPE SR UNDERLOAD RELAYS

CONNECTIONS OF UNDERLOAD RELAY AND CIRCUIT BREAKER OPERATED THROUGH SHUNT TRIP COIL



In this type of relay the pointer travels **down** the scale with **decrease** of load current and the pilot needle is placed to the **left** of the instrument needle. When used in connection with shunt trip circuit breaker the underload relay affords a means of readily varying the **underload** tripping point over a very wide range.

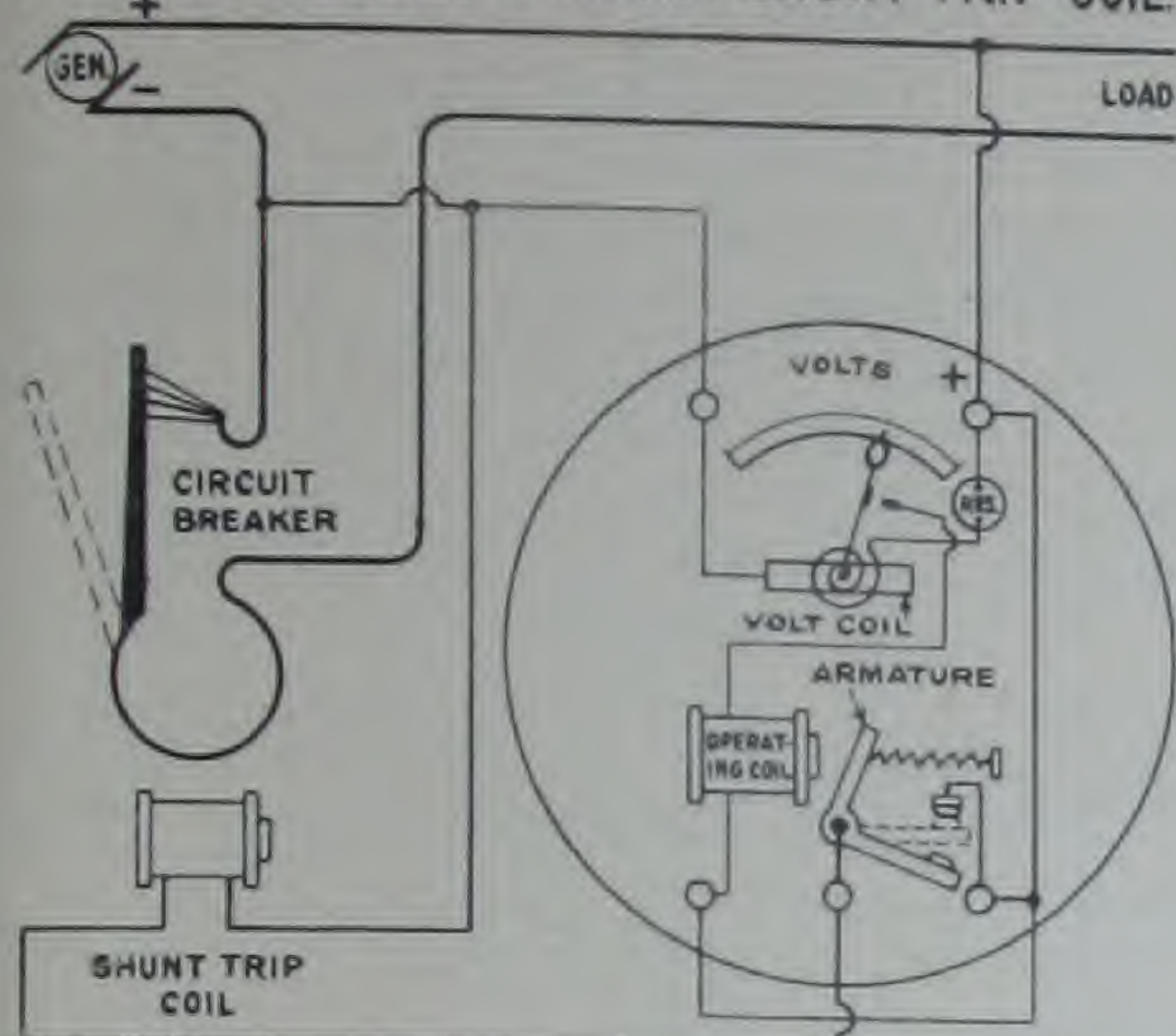
One application of our underload relay would be a case where it is desired to have a storage battery charging circuit opened automatically when the current falls (and before it reverses) to a definitely pre-determined value, due to failure of supply voltage or from any other cause. We would supply for this a shunt trip type circuit breaker complete with underload relay and shunt, the latter corresponding in ampere capacity to the circuit breaker rating. The underload tripping point could then be set **anywhere between zero and 100% of the shunt rating.**

Cat. No.	Description	List Price
55004	Underload Relay and leads, scale to suit shunt; with back connection studs	\$56.00

In ordering, specify quantity, catalog number, exact operating voltage and ampere capacity of shunt with which relay is to be used. The milli-volt drop of the shunt should be given also when relays are ordered for use with shunts other than ROLLER-SMITH. See page 5 for listing of shunts.

TYPE SR OVER-VOLTAGE RELAYS

CONNECTIONS OF OVERVOLTAGE RELAY AND CIRCUIT BREAKER OPERATED THROUGH SHUNT TRIP COIL.



Over-voltage relays differ in general construction from the reverse current, overload and underload relays in that the former are actuated by a change of line voltage while the latter function with a change in the current. The over-voltage relay has a voltmeter mechanism and is, of course, arranged to be connected across the line.

Over-voltage relays find their chief application on circuits where the voltage is unsteady and it is necessary to safeguard against the effect of excessive voltage increase. Storage battery charging can in many cases be facilitated by using an over-voltage relay to cut off the charging current when the battery voltage rises to a predetermined value. For both purposes the main circuits are opened by

means of shunt trip circuit breakers with which the relays are connected.

The complete outfit would comprise a shunt trip type circuit breaker and an over-voltage relay. The over-voltage relay would be made to correspond to the line voltage used. Suppose, for instance, the latter is 110 volts, we would then supply an over-voltage relay range 0-150 volts, the tripping point of which could be adjusted to any voltage value from zero to 150 volts the relay scale being calibrated to correspond.

Cat. No.	Description	List Price
55006	Over-voltage Relay, scale in volts; with back connection studs.	\$57.50

In ordering, specify quantity, catalog number, and maximum and minimum operating voltage.

TYPE SR UNDER-VOLTAGE RELAYS

These are identical with the over-voltage relays except that the pilot needle is mounted to the left of the indicating pointer.

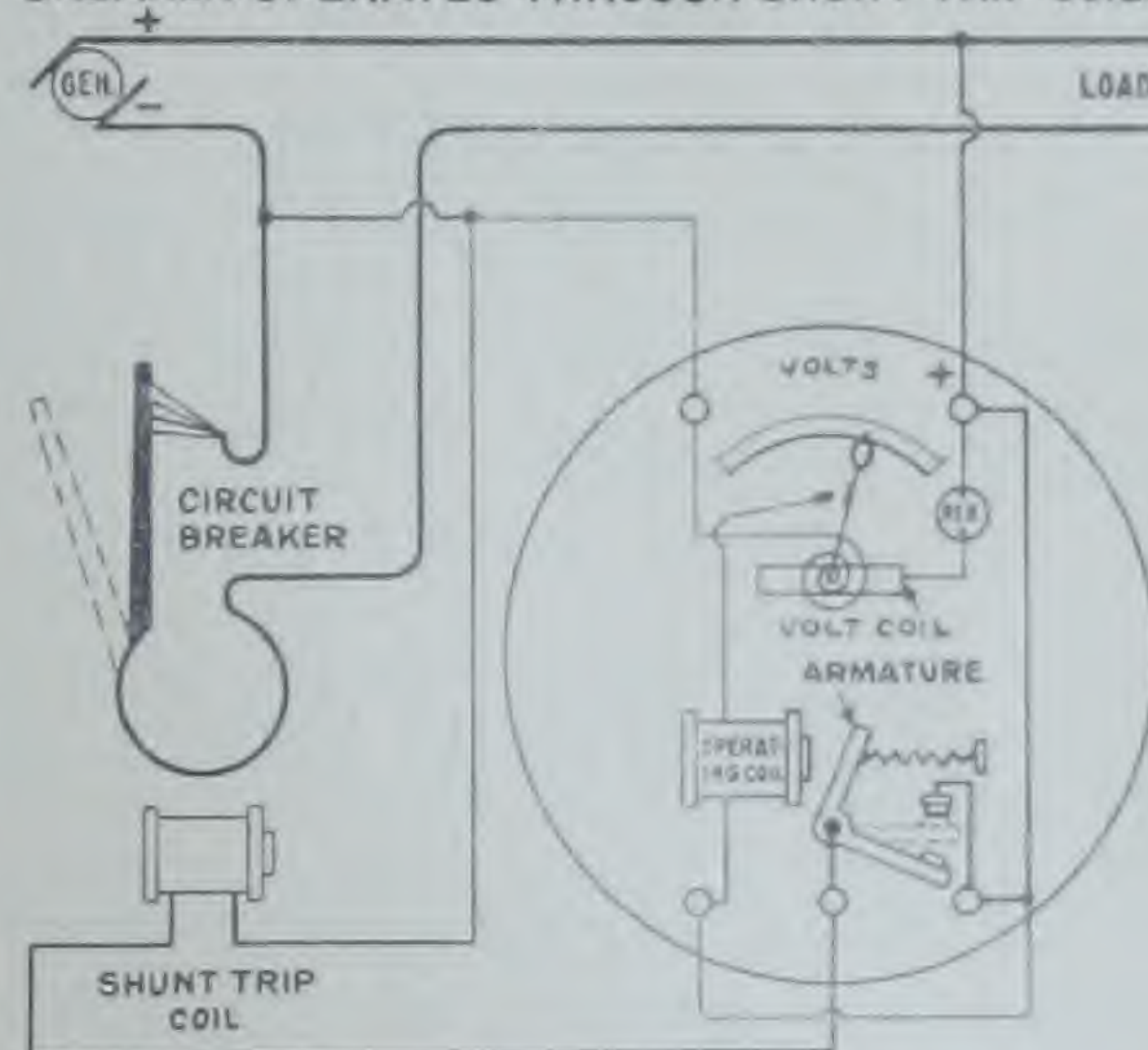
Under-voltage relays are especially desirable where it is desired to signal an attendant or automatically to cut off the current when the line voltage falls to a pre-determined minimum.

For the last mentioned case a shunt trip type circuit breaker and an under-voltage relay are necessary, the latter having a range depending on the normal line voltage used. Suppose, for example, the line voltage is 110 volts. An under-voltage relay range 0-150 volts would be supplied which could be set to function at any point between zero and 150 volts.

Cat. No.	Description	List Price
55008	Under-voltage Relay, scale in volts; with back connection studs.	\$57.50

In ordering, specify quantity, catalog number, and maximum and minimum operating voltage.

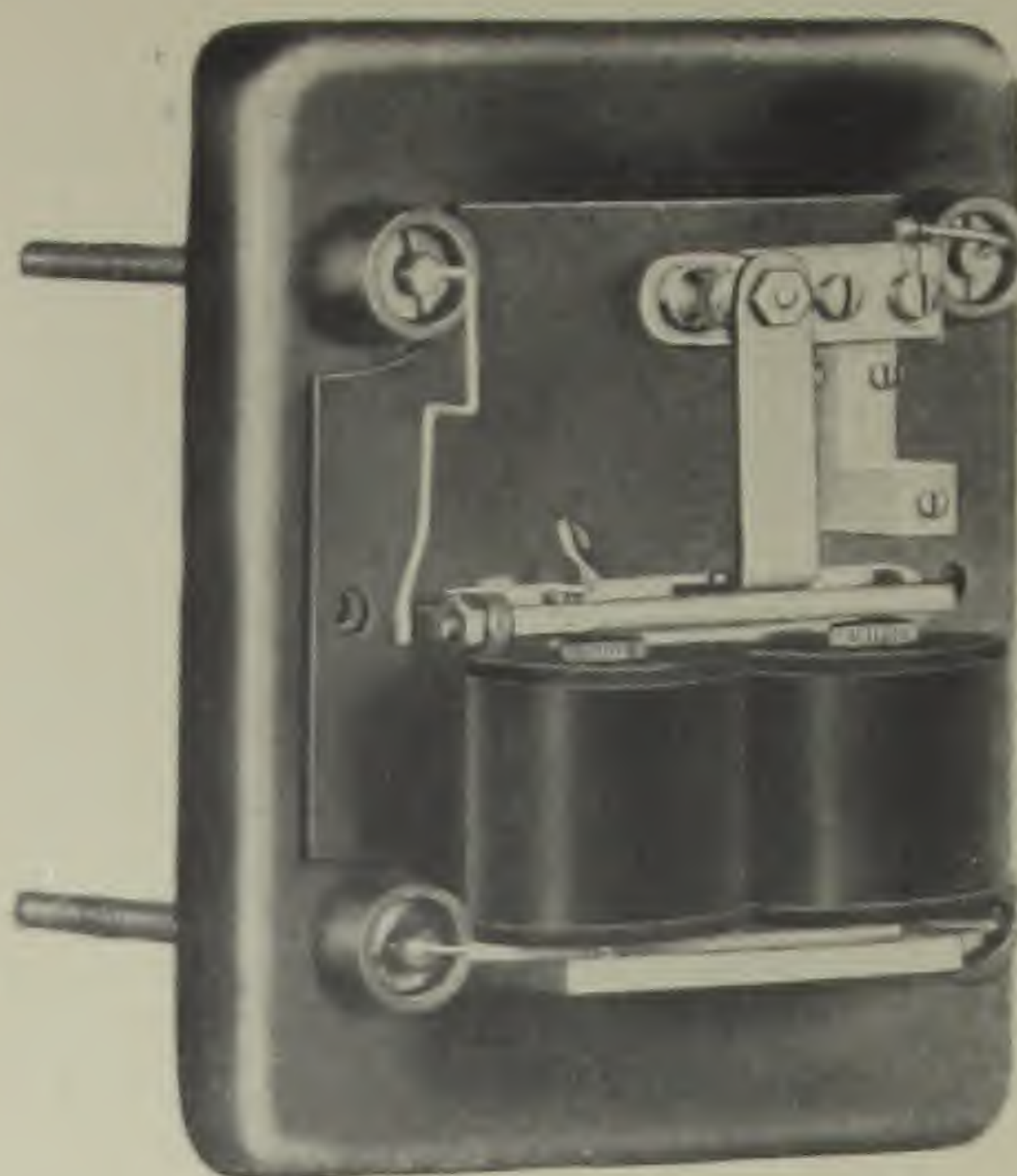
CONNECTIONS OF UNDERVOLTAGE RELAY AND CIRCUIT BREAKER OPERATED THROUGH SHUNT TRIP COIL.



SHUNTS (50 M. V. Drop)

Cat. No.	Ampere Capacity	List Price	Cat. No.	Ampere Capacity	List Price	Cat. No.	Ampere Capacity	List Price
4447	1	\$6.00	4481	100	\$6.00	4489	1500	\$34.00
4448	1.5	6.00	4482	150	6.00	4490	2000	40.00
4449	3	6.00	4483	200	7.00	4471	2500	42.50
4475	5	6.00	4484	300	8.00	4491	3000	45.00
4476	10	6.00	4485	400	8.00	4492	4000	70.00
4477	15	6.00	4486	500	10.00	4493	5000	104.00
4478	25	6.00	4487	750	15.00	4494	7500	150.00
4479	50	6.00	4488	1000	18.00			
4480	75	6.00	4495	1200	18.00			

TYPE FR RELAYS



Type FR Relay with Cover Off

R-S Type SR relays, listed in this Bulletin, have incorporated an electro-magnet and switch which are actuated by the contact making (or breaking) d'Arsonval instrument element contained in the same case. This electro-magnet and switch combination (the secondary relay) has been so successfully employed in the Type SR relay that we have decided to offer that secondary relay for the many purposes for which a device of that kind can be utilized so advantageously.

APPLICATIONS

One of the many possible applications for the Type FR relay is in connection with contact-making instruments, meters and similar devices, wherein it is desired to have a small current operate devices requiring a relatively large current. For example, the ringing of bells, lighting of lamps and operation of circuit breaker tripping coils, etc., are things that cannot be done directly from the contact members of contact-making instruments and meters, as the moving members, springs and contact points must, of necessity, be extremely small and light. By the interposition of a Type FR relay the necessary amount of current can safely be used. The

Type FR relay is susceptible of many modifications to meet special conditions and correspondence regarding such is invited.

CONSTRUCTION

The Type FR relay is mounted on a rectangular aluminum base and the mechanism is covered by a punched metal cap, black rubberoid finish. Four threaded studs (#10-32, 2 3/8" long) serve as terminals and, also, to support the relay on the switchboard. By the removal of the case, which is accomplished by taking out only two screws, the interior is made accessible for inspection and adjustments. The overall dimensions of the relay are 4" wide by 5" high by 2 1/4" deep (not including the studs).

The relay mechanism consists of an electro-magnet having two coils (in series), which coils may be wound for either A.C. or D.C. potential. The potential may be low in value (as low as 4 volts) but on such low voltage relays the current consumption will be comparatively high, which, for certain applications, may be objectionable. The potential may be as high as 250 volts. On special order we can supply these relays for potentials over 250 volts, but such should be the subject of special correspondence.

Approximately .375 watt is necessary for the operation of the coils, from which can be figured the approximate current draw at a given voltage. The electro-magnet actuates a hinged armature, which armature carries the moving blade of a specially constructed switch. The switch contacts for direct current relays are of carbon. On A.C. relays the switch construction is slightly different, and platinum contacts are employed. The design is such as to make replacement easy in the event of their becoming damaged. The relay switch is designed to make or break a circuit not exceeding 2 amperes at 250 volts. The relay switch and its contacts are so arranged that they may be normally open when the relay coils are not energized or normally closed when the relay coils are not energized.

CONNECTIONS

Of the four terminal studs built into the instruments, two serve as terminals for the operating coil and the other two are connected to the switch members. The two circuits through the instrument are entirely separate from each other and currents of different characteristics may be employed in each circuit.

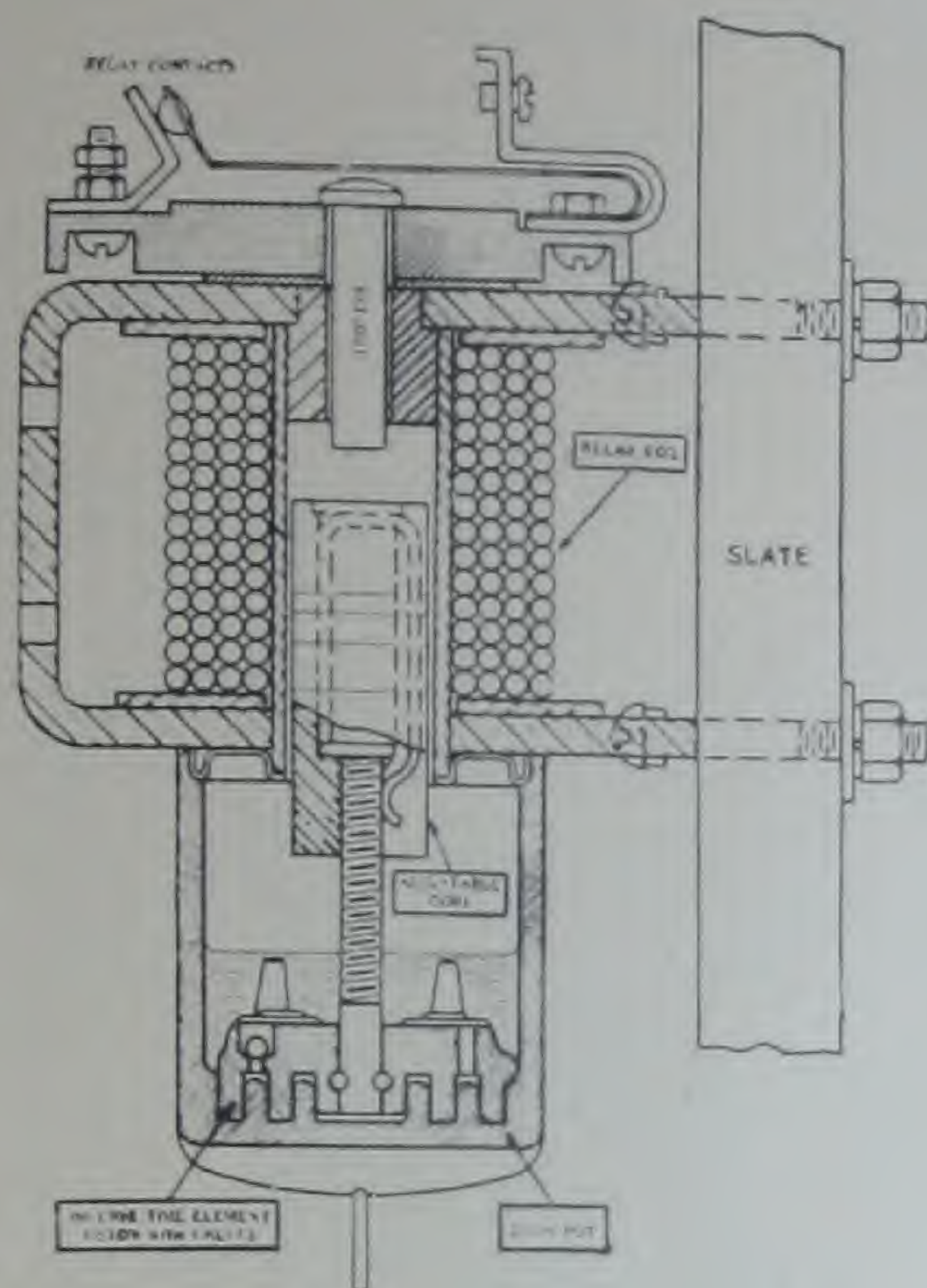
Cat. No.	Description	List Price
55012	Type FR Relay back connected, circuit closing form, potential coil wound for any given A.C. or D.C. potential not exceeding 250 volts.....	\$16.00
55014	Type FR Relay, back connected, circuit opening form, potential coil wound for any given A.C. or D.C. potential not exceeding 250 volts.....	\$16.00

Directions for ordering. Specify quantity, catalog number and actual potential for which coil should be wound; if current is alternating specify frequency. Also specify characteristic of circuit to be operated by switch and specify functions of switch.

Note. In the circuit closing form the switch contacts are normally open and close when the coil is energized.

In the circuit opening form the switch contacts are normally closed and open when the coil is energized.

TYPE AB TIME LIMIT RELAYS



TIME LIMIT RELAYS

ROLLER-SMITH Type AB Time Limit Relays are used in connection with standard ROLLER-SMITH breakers in order to give the necessary delayed trip which is necessary when starting motors taking a heavy current, or in similar applications. The time limit relay actuates either an under-voltage or shunt trip attachment carried by the breaker. Short circuits and exceptionally heavy overloads are taken care of by the overload coil of the breaker which is set at 500% load when used with an AB Time Limit Relay.

They are calibrated to work from a range of 66 $\frac{2}{3}$ % to 200% of the normal rating. When used on D.C., the relays trip at 93% of the alternating current values.

SINGLE POLE TYPE AB TIME LIMIT RELAYS

600 volts and under, A.C. and D.C.

Rated Amp. Capacity	Range of Adjustment	List Price	Rated Amp. Capacity	Range of Adjustment	List Price
3 Amps.	2 to 6 Amps.	\$26.00	400 "	266 to 800 "	16.00
5 "	3 to 10 "	26.00	500 "	332 to 1000 "	16.00
10 "	6 to 20 "	26.00	600 "	400 to 1200 "	50.00
15 "	10 to 30 "	26.00	800 "	532 to 1600 "	50.00
20 "	14 to 40 "	28.00	1000 "	666 to 2000 "	57.50
30 "	20 to 60 "	28.00	1200 "	800 to 2400 "	60.00
45 "	30 to 90 "	28.00	1500 "	1000 to 3000 "	65.00
60 "	40 to 120 "	30.00	1800 "	1200 to 3600 "	70.00
80 "	52 to 160 "	30.00	2000 "	1333 to 4000 "	72.50
100 "	60 to 200 "	32.00	2500 "	1666 to 5000 "	75.00
150 "	100 to 300 "	32.00	3000 "	2000 to 6000 "	80.00
200 "	133 to 400 "	32.00	4000 "	2666 to 8000 "	100.00
300 "	200 to 600 "	35.00			

Type AB relays are normally "open circuit," i.e., they function by **closing** the shunt trip coil of a suitable circuit breaker. On special order and without extra charge they can be supplied in the normally "closed circuit" type, i.e., they function by **opening** the circuit through the under-voltage coil of a suitable circuit breaker. The former is, in nearly all cases, preferable unless under-voltage protection is wanted.

When relays are wanted for switchboard mounting with back connections, studs are supplied, the length of which is the same as that of a circuit breaker of the same ampere capacity. If wanted for wall mounting with front connections we use the same arrangement as on front connected circuit breakers. When relays are supplied **with** front connected circuit breakers on the same base the terminal arrangement is provided for in proper fashion.

Each relay is supplied with full instructions and with the proper amount of oil in a separate container.

When ordering circuit breakers with time limit relays, orders should always specify

how many relays are wanted. For 2 wire, D.C. one relay is usually sufficient; for 3 wire, D.C. two relays; for single phase, 2 wire, A.C. one relay; for single phase, 3 wire, A.C. two relays; for polyphase A.C. two relays, although in certain special cases three or even four relays may be needed.

The prices given cover relays ordered either separately or with circuit breakers.

Note that circuit breakers for use with relays must always be of the shunt trip or under-voltage type as may be selected.

In ordering, specify quantity; ampere capacity; whether A. C. or D. C. and, if A. C., the frequency; whether normally "closed circuit" or normally "open circuit"; style of mounting; operating voltage and, when relays are ordered separately from circuit breakers, the application and any details that would be of use to the factory in determining proper overload setting.

On special order and without extra charge Type AB Relays will be supplied in the "instantaneous trip" style. This is accomplished merely by omitting the oil from the dash pot, thus eliminating the "delayed action."

ROLLER-SMITH Products comprise complete lines of Electrical Instruments, indicating and graphic, Relays and air and oil Circuit Breakers. Bulletins covering the various devices will be sent on request.



WORKS OF ROLLER-SMITH COMPANY, BETHLEHEM, PA.

GUARANTEE

THE ROLLER-SMITH COMPANY guarantees **all** its apparatus to be made of materials carefully selected as best suited to the respective requirements and flawless so far as inspection and test preliminary to shipment can determine. It will replace or repair, within one year from date of sale, any defective apparatus provided it is returned f. o. b. the Company's Works at Bethlehem, Pa., for that purpose.

ROLLER-SMITH Representatives

Sales Offices

ATLANTA . . . 101 Marietta Street
 BOSTON . . . 88 Broad Street
 BUFFALO . . . Ellicott Square Building
 CHICAGO . . . 53 W. Jackson Blvd.
 CLEVELAND . . . 1988 E. 66th Street
 DENVER . . . Kittridge Building
 DETROIT . . . Fisher Building
 HOUSTON . . . 1006 Washington Avenue
 LOS ANGELES . . . 912 E. Third Street
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NEW YORK . . . 233 Broadway
 NEW ORLEANS . . . Masonic Temple
 OMAHA . . . W. O. W. Building
 PHILADELPHIA . . . Otis Building
 PITTSBURGH . . . First Nat. Bank Bldg.
 ST. LOUIS . . . Natl. Bk. of Com. Bldg.
 ST. PAUL . . . Pioneer Building
 SAN FRANCISCO . . . 163-2nd Street
 SEATTLE . . . Alaska Building
 TORONTO . . . 183 George Street

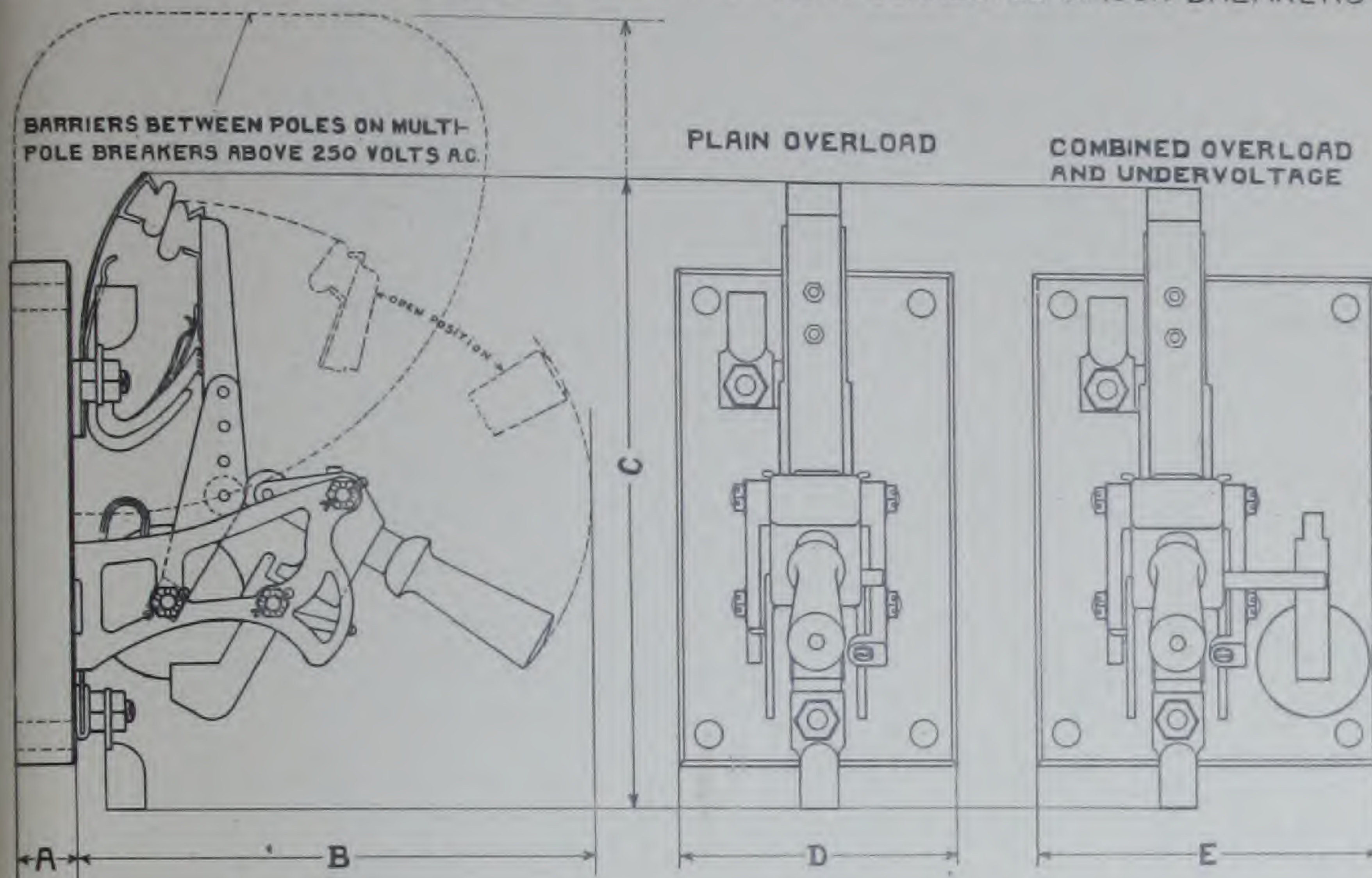
ABROAD

THRELL ELECTRIC COMPANY . . . Box 2049, Havana, Cuba
 DUVAL TRADING CO. Kembla Bldgs., Sydney, Australia
 ASHIDA ENGINEERING CO. Daini, Osaka, Japan
 MANILA MACHINERY & SUPPLY CO., INC.,
 Box 607, Manila, Philippine Islands





OVERALL DIMENSIONS OF INDUSTRIAL TYPE FRONT CONNECTED CIRCUIT BREAKERS



ALL DIMENSIONS IN INCHES

FRAME NO.	AMPS	POLES	A	B		C		D	E	APPROXIMATE WEIGHT IN LBS.	
				SINGLE POLE OR MULTI-POLE INDEP. ARM	MULTI-POLE RIGID ARM	UP TO 250 V. INCLUSIVE	250-440 V. A.C. INCLUSIVE			NET	GROSS
1	3-5-10-15 30-45-60-80	1	$\frac{3}{4}$	$6\frac{3}{8}$	$7\frac{1}{8}$	$8\frac{1}{2}$	FRAME NOT USED ABOVE 250 VOLTS	3	$4\frac{1}{2}$	$5\frac{1}{2}$	$12\frac{1}{2}$
1		2	$\frac{3}{4}$	$6\frac{3}{8}$	$7\frac{1}{8}$	$8\frac{1}{2}$		$7\frac{1}{2}$	$7\frac{1}{2}$	11	18
1		3	$\frac{3}{4}$	$6\frac{3}{8}$	$7\frac{1}{8}$	$8\frac{1}{2}$		$11\frac{5}{8}$	$11\frac{5}{8}$	$14\frac{1}{4}$	21
1		4	$\frac{3}{4}$	$6\frac{3}{8}$	$7\frac{1}{8}$	$8\frac{1}{2}$		$15\frac{3}{4}$	$15\frac{3}{4}$	$18\frac{1}{2}$	39
$2\frac{1}{2}$	100	1	1	$8\frac{3}{8}$	$10\frac{1}{2}$	$9\frac{7}{8}$	$9\frac{7}{8}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$9\frac{1}{2}$	17
$2\frac{1}{2}$		2	1	$8\frac{3}{8}$	$10\frac{1}{2}$	$9\frac{7}{8}$	$12\frac{3}{4}$	$10\frac{1}{2}$	$10\frac{1}{2}$	24	31
$2\frac{1}{2}$		3	1	$8\frac{3}{8}$	$10\frac{1}{2}$	$9\frac{7}{8}$	$12\frac{3}{4}$	$15\frac{1}{2}$	$15\frac{1}{2}$	28	48
$2\frac{1}{2}$		4	1	$8\frac{3}{8}$	$10\frac{1}{2}$	$9\frac{7}{8}$	$12\frac{3}{4}$	21	21	37	68

All dimensions are approximate and should be used for reference purposes only.
Certified prints furnished on request.

ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK



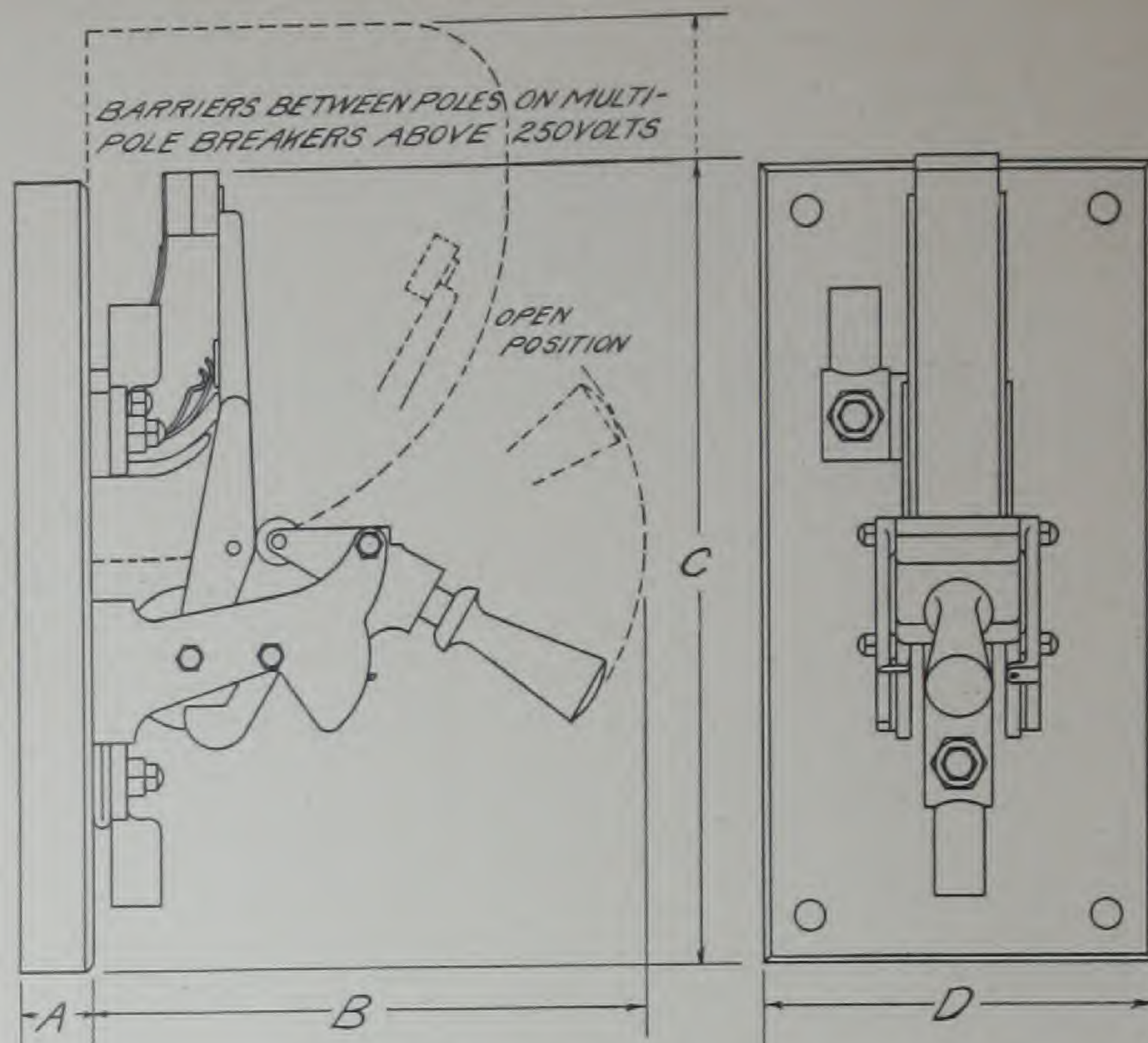
WORKS:
Bethlehem, Pennsylvania

Offices in Principal Cities in United States and Canada

Representatives in
Australia, Cuba, Japan and Philippine Islands

OVERALL DIMENSIONS OF STANDARD TYPE FRONT CONNECTED CIRCUIT BREAKERS PLAIN OVERLOAD

DATA SHEET DE



ALL DIMENSIONS IN INCHES

FRAME NO	AMPS	POLES	A	B		C		D	APPROXIMATE WEIGHT IN LBS	
				SINGLE POLE OR MULTIPOLE INDEPENDENT ARM	MULTIPOLE RIGID ARM	UP TO 250VOLTS INCLUSIVE	260-600VOLTS INCLUSIVE		NET	GROSS
2	5-10-20-30 45-60-80	1	1	8 $\frac{1}{4}$		11 $\frac{1}{4}$	11 $\frac{1}{4}$	5 $\frac{1}{2}$	14	21
2		2	1	8 $\frac{1}{4}$	11	11 $\frac{1}{4}$	13 $\frac{5}{8}$	12	33	49
2		3	1	8 $\frac{1}{4}$	11	11 $\frac{1}{4}$	13 $\frac{5}{8}$	16 $\frac{1}{2}$	50	69
2		4	1 $\frac{1}{4}$	8 $\frac{1}{4}$	12	11 $\frac{1}{4}$	13 $\frac{5}{8}$	21	62	92
3	100-150-200	1	1	10 $\frac{1}{4}$		13 $\frac{1}{8}$	13 $\frac{1}{8}$	7	32	48
3		2	1	10 $\frac{1}{4}$	12 $\frac{1}{2}$	13 $\frac{1}{8}$	16 $\frac{1}{4}$	15	40	75
3		3	1 $\frac{1}{4}$	10 $\frac{1}{4}$	14 $\frac{1}{2}$	13 $\frac{1}{8}$	16 $\frac{1}{4}$	22	73	108
3		4	1 $\frac{1}{2}$	10 $\frac{1}{4}$	15 $\frac{1}{2}$	13 $\frac{1}{8}$	17	28	112	182
4	300-400-500	1	1 $\frac{1}{4}$	13		18	18	11	59	79
4		2	1 $\frac{1}{4}$	13	17 $\frac{1}{2}$	18	22 $\frac{1}{2}$	20	104	154
4		3	1 $\frac{1}{2}$	13	19	18	22 $\frac{1}{2}$	28	154	214
4		4	1 $\frac{1}{2}$	13	19	18	22 $\frac{1}{2}$	36	200	292
4 $\frac{1}{2}$	600-800	1	1 $\frac{1}{4}$	13		18 $\frac{1}{2}$	18 $\frac{1}{2}$	11	63	84
4 $\frac{1}{2}$		2	1 $\frac{1}{4}$	13	17 $\frac{1}{2}$	18 $\frac{1}{2}$	23	20	110	164
4 $\frac{1}{2}$		3	1 $\frac{1}{2}$	13	19	18 $\frac{1}{2}$	23	28	162	240
4 $\frac{1}{2}$		4	1 $\frac{1}{2}$	13	19	18 $\frac{1}{2}$	23	36	212	310
5	1000-1200	1	2	15		24	24	15	120	175
5		2	2	15	21 $\frac{1}{4}$	24	29	24	250	320
5		3	2	15	21 $\frac{1}{4}$	24	29	30	311	410
5		4	2	15	30	24	29	40	390	510

FRAME 2 HAS STRAIGHT HANDLE ON EITHER SINGLE POLE OR INDEPENDENT ARM MULTIPOLE OR 2 AND 3 POLE RIGID ARM AND SPADE HANDLE ON 4 POLE RIGID ARM

FRAME 3 HAS STRAIGHT HANDLE ON EITHER SINGLE POLE OR INDEPENDENT ARM MULTIPOLE AND SPADE HANDLE ON MULTIPOLE RIGID ARM

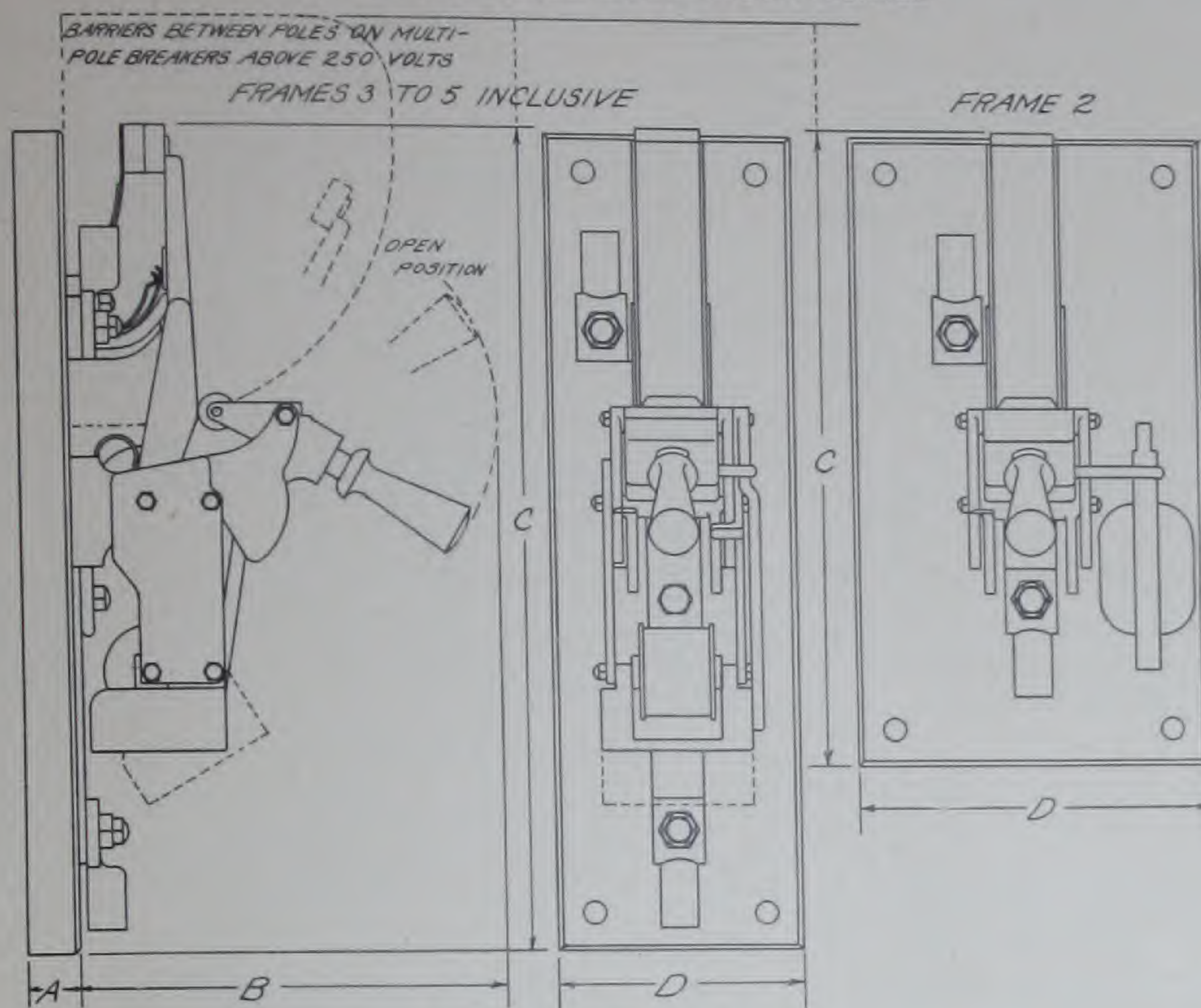
FRAMES 4 AND 4 $\frac{1}{2}$ HAVE SPADE HANDLES ON EITHER SINGLE POLE OR INDEPENDENT OR RIGID ARM MULTIPOLE

FRAME 5 HAS SPADE HANDLE ON SINGLE POLE OR INDEPENDENT ARM AND 2 AND 3 POLE RIGID ARM

FRAME 5 HAS REMOVABLE HANDLE ON 4 POLE RIGID ARM

ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE USED FOR REFERENCE ONLY
CERTIFIED PRINTS FURNISHED ON REQUEST

OVERALL DIMENSIONS OF *STANDARD TYPE* FRONT CONNECTED CIRCUIT BREAKERS
COMBINED OVERLOAD AND UNDERVOLTAGE

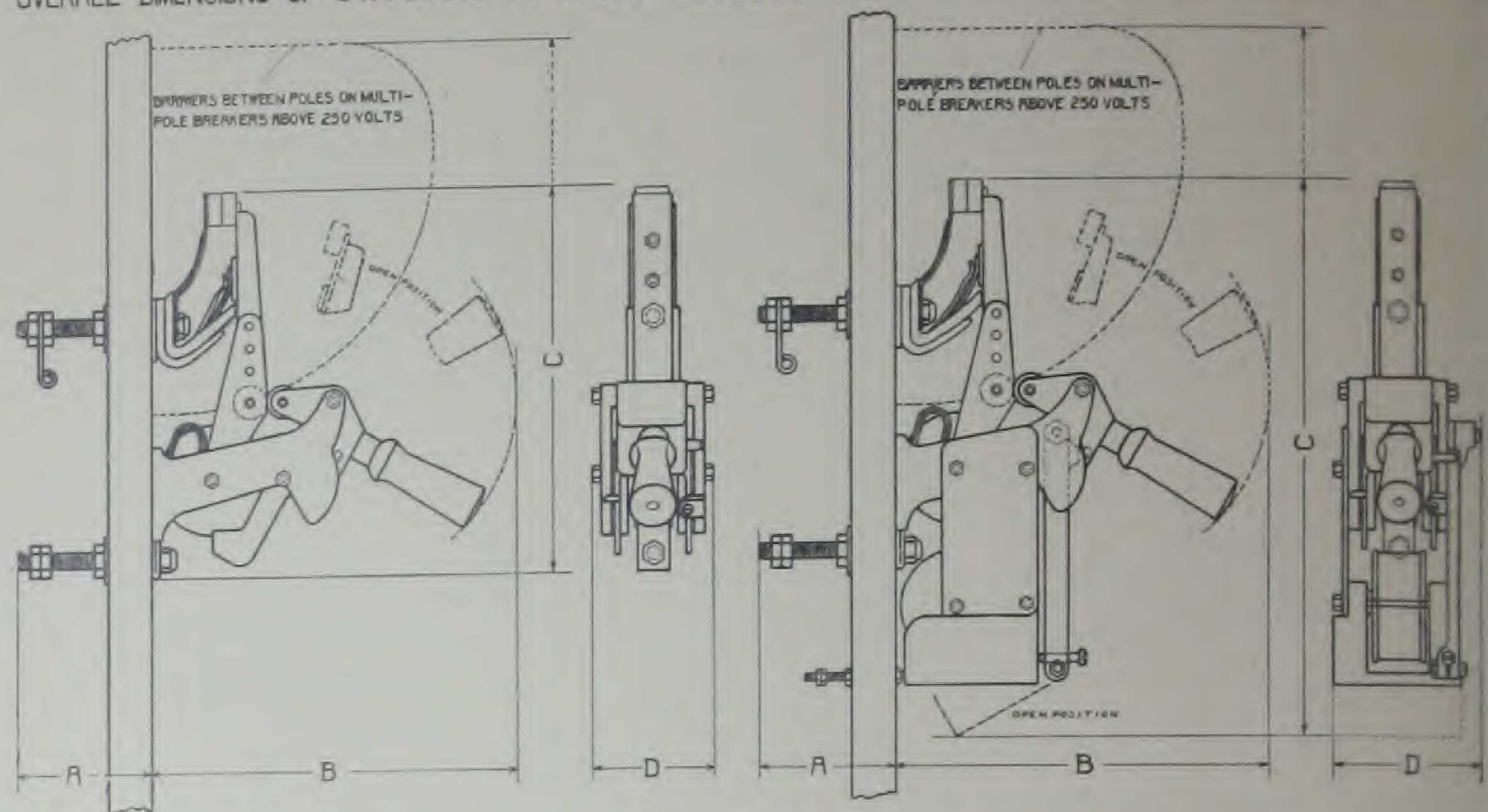


ALL DIMENSIONS IN INCHES

FRAME NO.	AMPS	POLES	A	B		C		D	APPROXIMATE WEIGHT IN LBS.	
				SINGLE POLE OR MULTIPOLE INDEPENDENT ARM	MULTIPOLE RIGID ARM	UP TO 250 VOLTS INCLUSIVE	260-600 VOLTS INCLUSIVE		NET	GROSS
2	5-10-20-30 45-60-80	1	1	8 $\frac{1}{4}$		11 $\frac{1}{2}$	11 $\frac{1}{2}$	7	14	21
2		2	1	8 $\frac{1}{4}$	11	11 $\frac{1}{2}$	13 $\frac{5}{8}$	12	33	49
2		3	1	8 $\frac{1}{4}$	11	11 $\frac{1}{2}$	13 $\frac{5}{8}$	16 $\frac{1}{2}$	50	69
2		4	1 $\frac{1}{4}$	8 $\frac{1}{4}$	12	11 $\frac{1}{2}$	13 $\frac{5}{8}$	21	60	92
3	100-150-200	1	1	10 $\frac{1}{4}$		18	18	7	32	48
3		2	1	10 $\frac{1}{4}$	12 $\frac{1}{2}$	18	20 $\frac{5}{8}$	15	40	75
3		3	1 $\frac{1}{4}$	10 $\frac{1}{4}$	14 $\frac{1}{2}$	18	20 $\frac{5}{8}$	22	73	108
3		4	1 $\frac{1}{2}$	10 $\frac{1}{4}$	15 $\frac{1}{2}$	18	20 $\frac{5}{8}$	28	112	182
4	300-400-500	1	1 $\frac{1}{4}$	13		26 $\frac{1}{8}$	30 $\frac{1}{2}$	11	59	79
4		2	1 $\frac{1}{4}$	13	17 $\frac{1}{2}$	26 $\frac{1}{8}$	30 $\frac{1}{2}$	20	104	154
4		3	1 $\frac{1}{2}$	13	19	26 $\frac{1}{8}$	30 $\frac{1}{2}$	28	154	214
4		4	1 $\frac{1}{2}$	13	19	26 $\frac{1}{8}$	30 $\frac{1}{2}$	36	200	292
4 $\frac{1}{2}$	600-800	1	1 $\frac{1}{4}$	13		26 $\frac{1}{8}$	30 $\frac{1}{2}$	11	63	84
4 $\frac{1}{2}$		2	1 $\frac{1}{4}$	13	17 $\frac{1}{2}$	26 $\frac{1}{8}$	30 $\frac{1}{2}$	20	110	164
4 $\frac{1}{2}$		3	1 $\frac{1}{2}$	13	19	26 $\frac{1}{8}$	30 $\frac{1}{2}$	28	162	240
4 $\frac{1}{2}$		4	1 $\frac{1}{2}$	13	19	26 $\frac{1}{8}$	30 $\frac{1}{2}$	36	212	310
5	1000-1200	1	2	15		28	28	14	120	175
5		2	2	15	21 $\frac{1}{4}$	28	33	21	250	320
5		3	2	15	21 $\frac{1}{4}$	28	33	30	311	410
5		4	2	15	30	28	33	40	390	510

FRAME 2 HAS STRAIGHT HANDLE ON EITHER SINGLE POLE OR INDEPENDENT ARM MULTIPOLE OR 2 AND 3 POLE RIGID ARM AND SPADE HANDLE ON 4 POLE RIGID ARM
 FRAME 3 HAS STRAIGHT HANDLE ON EITHER SINGLE POLE OR INDEPENDENT ARM MULTIPOLE AND SPADE HANDLE ON MULTIPOLE RIGID ARM
 FRAMES 4 AND 4 $\frac{1}{2}$ HAVE SPADE HANDLES ON EITHER SINGLE POLE OR INDEPENDENT OR RIGID ARM MULTIPOLE
 FRAME 5 HAS SPADE HANDLE ON SINGLE POLE OR INDEPENDENT OR RIGID ARM 2 AND 3 POLE AND REMOVABLE HANDLE ON 4 POLE RIGID ARM
 ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE USED FOR REFERENCE ONLY
 CERTIFIED PRINTS FURNISHED ON REQUEST

OVERALL DIMENSIONS OF STANDARD TYPE BACK CONNECTED CIRCUIT BREAKERS UP TO 1200 AMPERES INCLUSIVE



ALL DIMENSIONS IN INCHES

PLAIN OVERLOAD

FRAME NO.	AMPS	POLES	A	B				C				D	APPROXIMATE WEIGHT IN POUNDS	
				SINGLE POLE RIGID ARM	MULTIPOLE RIGID ARM	UP TO 250 VOLTS INCL. SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM	250-400 VOLTS INCL. SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM	400-600 VOLTS INCL. SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM		NET	CROSS
2	30	1	4 1/2	8 1/4		9 1/2		9 1/2		2 7/8		5	12	
2	20-60	2	4 1/2	8 1/4	9	9 1/2	11	11 1/2	13	7 3/8	10 1/2	18		
2	10-60	3	4 1/2	8 1/4	9	9 1/2	11	11 1/2	13	11 7/8	19	32		
2	5-45	4	4 1/2	8 1/4	9	9 1/2	11 1/2	11 1/2	13 1/2	16 3/8	26	58		
3	200	1	4 1/2	10 1/2		11 7/8		11 7/8		3 1/2	12	25		
3	150-200	2	4 1/2	10 1/2	12 1/2	11 7/8	12 7/8	15 1/8	16 1/8	9	26	39		
3	100-150	3	4 1/2	10 1/2	14 1/2	11 7/8	12 7/8	15 1/8	16 1/8	14 1/2	39	69		
3	100-150	4	4 1/2	10 1/2	16	11 7/8	13 7/8	15 1/8	17 1/8	20	58	98		
4	300	1	5	12 3/4		15 3/4		15 3/4		5 1/2	27	47		
4	200-300	2	5	12 3/4	17 1/2	15 3/4	15 3/4	20 1/4	20 1/4	12 1/2	57	90		
4	100-400	3	5	12 3/4	19	15 3/4	16	20 1/4	20 1/2	19 1/2	92	125		
4	300-400-500	4	5	12 3/4	19	15 3/4	16	20 1/4	20 1/2	26 1/2	147	207		
4 1/2	800	1	5 1/2	12 3/4		15 3/4		15 3/4		5 1/2	41	61		
4 1/2	600-800	2	5 1/2	12 3/4	17 1/2	15 3/4	15 3/4	20 1/4	20 1/4	12 1/2	84	127		
4 1/2	400-600	3	5 1/2	12 3/4	19	15 3/4	16	20 1/4	20 1/2	19 1/2	110	143		
4 1/2	300-600	4	5 1/2	12 3/4	19	15 3/4	16	20 1/4	20 1/2	26 1/2	170	230		
5	1200	1	6	14 3/4		17		17		6	57	90		
5	1000-1200	2	6	14 3/4	21	17	17 1/2	22 1/2	23	14	118	158		
5	800-1000	3	6	14 3/4	21	17	17 1/2	22 1/2	23	22	177	237		
5	600-800	4	6	14 3/4	30	17	21 1/4	22 1/2	22 1/2	30	250	330		

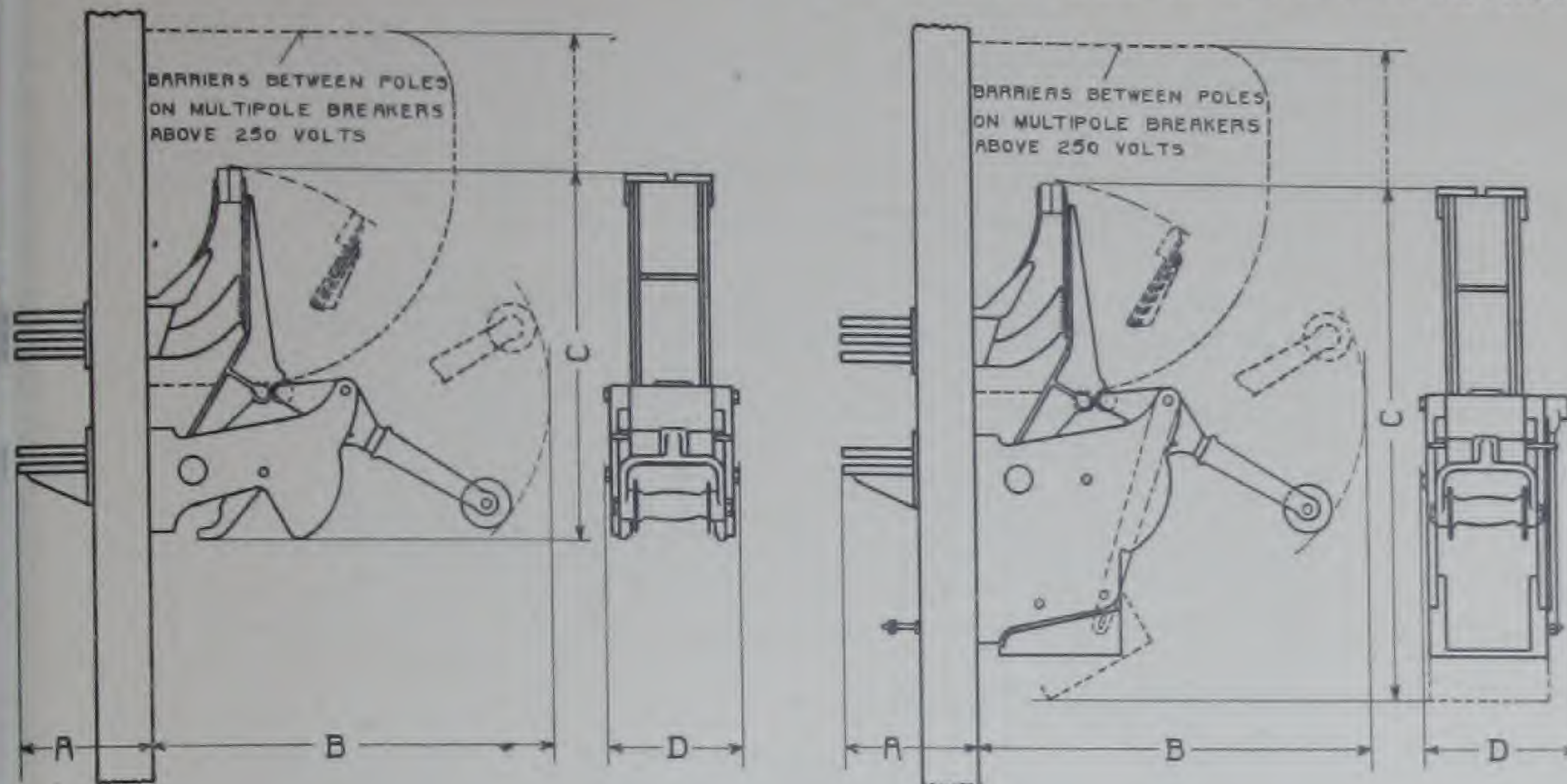
COMBINED OVERLOAD AND UNDERVOLTAGE

FRAME NO.	AMPS	POLES	A	B				C				D	APPROXIMATE WEIGHT IN POUNDS	
				SINGLE POLE RIGID ARM	MULTIPOLE RIGID ARM	UP TO 250 VOLTS INCL. SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM	250-400 VOLTS INCL. SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM	400-600 VOLTS INCL. SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM		NET	CROSS
2	30	1	4 1/2	8 1/4		13 3/8		13 3/8		3 1/8	8 1/2	15 1/2		
2	20-60	2	4 1/2	8 1/4	11	13 3/8	13 3/8	15 3/8	15 3/8	7 3/8	15 1/4	22		
2	10-60	3	4 1/2	8 1/4	11	13 3/8	13 3/8	15 3/8	15 3/8	11 7/8	24	36		
2	5-45	4	4 1/2	8 1/4	12	13 3/8	13 3/8	15 3/8	15 3/8	16 3/8	32	63		
3	200	1	4 1/2	10 1/2		15 3/8		15 3/8		3 3/4	16 1/4	32		
3	150-200	2	4 1/2	10 1/2	14 1/2	15 3/8	15 3/8	18 3/8	18 3/8	9 1/4	32 1/2	54		
3	100-150	3	4 1/2	10 1/2	14 1/2	15 3/8	15 3/8	18 3/8	18 3/8	14 1/2	45 1/2	78		
3	100-150	4	4 1/2	10 1/2	16	15 3/8	15 3/8	18 3/8	18 3/8	20 1/4	64	105		
4	300	1	5	12 3/4		21 1/2		21 1/2		5 1/2	42	55		
4	200-300	2	5	12 3/4	17 1/2	21 1/2	21 1/2	26	26	12 1/2	71	110		
4	100-400	3	5	12 3/4	19	21 1/2	21 1/2	26	26	19 1/2	107	157		
4	300-400-500	4	5	12 3/4	19	21 1/2	21 1/2	26	26	26 1/2	162	222		
4 1/2	800	1	5 1/2	12 3/4		21 1/2		21 1/2		5 1/2	56	69		
4 1/2	600-800	2	5 1/2	12 3/4	17 1/2	21 1/2	21 1/2	26	26	12 1/2	93	133		
4 1/2	400-600	3	5 1/2	12 3/4	19	21 1/2	21 1/2	26	26	19 1/2	113	163		
4 1/2	300-600	4	5 1/2	12 3/4	19	21 1/2	21 1/2	26	26	26 1/2	168	228		
5	1200	1	6	14 3/4		23		23		7	78	110		
5	1000-1200	2	6	14 3/4	21	23	23	28 1/2	28 1/2	15	138	188		
5	800-1000	3	6	14 3/4	21	23	23	28 1/2	28 1/2	28	197	257		
5	600-800	4	6	14 3/4	30	23	23	28 1/2	28 1/2	31	255	330		

FRAMES 2 AND 3 HAVE STRAIGHT HANDLES ON EITHER SINGLE POLE OR INDEP. ARM MULTIPOLE.
 FRAME 2 HAS STRAIGHT HANDLE AND FRAME 3 HAS SPADE HANDLE ON RIGID ARM MULTIPOLE.
 FRAMES 4 AND 4 1/2 HAVE SPADE HANDLES ON EITHER SINGLE POLE OR INDEP. OR RIGID ARM MULTIPOLE.
 FRAME 5 HAS SPADE HANDLE ON SINGLE POLE OR INDEP. ARM AND 2 AND 3 POLE RIGID ARM.
 FRAME 5 HAS REMOVABLE HANDLE ON 4 POLE RIGID ARM.

ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE USED FOR REFERENCE ONLY.
 CERTIFIED PRINTS FURNISHED ON REQUEST.

OVERALL DIMENSIONS OF STANDARD TYPE BACK CONNECTED CIRCUIT BREAKERS 1500 AMPERES AND OVER



ALL DIMENSIONS IN INCHES

PLAIN OVERLOAD

FRAME NO.	AMPS	POLES	A	B		C		D	APPROXIMATE WEIGHT IN POUNDS	
				SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM	UP TO 250 VOLTS INC.	250 TO 600 VOLTS INC.		NET	GROSS
6	D.C.	1	6	22 $\frac{1}{2}$		20	25	7 $\frac{3}{8}$	107	155
6	1500-2000 D.C.	2	6	22 $\frac{1}{2}$	17 $\frac{1}{2}$	20	25	17 $\frac{1}{4}$	214	310
6	1500-2000 D.C.	3	6	22 $\frac{1}{2}$	17 $\frac{1}{2}$	20	25	25 $\frac{3}{8}$	321	465
6	1500-2000 D.C.	4	6	22 $\frac{1}{2}$	17 $\frac{1}{2}$	20	25	34 $\frac{3}{8}$	428	620
6 $\frac{1}{2}$	2500-3000 D.C.	1	7 $\frac{1}{4}$	18 $\frac{1}{2}$		22	30	7 $\frac{3}{4}$	117	165
6 $\frac{1}{2}$	2500-3000 D.C.	2	7 $\frac{1}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	22	30	17 $\frac{3}{4}$	234	330
6 $\frac{1}{2}$	2500-3000 D.C.	3	7 $\frac{1}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	22	30	27 $\frac{3}{4}$	351	495
6 $\frac{1}{2}$	2500-3000 D.C.	4	7 $\frac{3}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	22	30	37 $\frac{3}{4}$	468	660
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	1	7 $\frac{3}{4}$	18 $\frac{1}{2}$		22	30	11 $\frac{1}{4}$	140	190
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	2	7 $\frac{3}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	22	30	24 $\frac{3}{4}$	280	380
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	3	7 $\frac{3}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	22	30	38 $\frac{1}{4}$	420	570
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	4	8 $\frac{1}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	22	30	51 $\frac{3}{4}$	560	760

COMBINED OVERLOAD AND UNDERVOLTAGE

FRAME NO.	AMPS	POLES	A	B		C		D	APPROXIMATE WEIGHT IN POUNDS	
				SINGLE POLE OR MULTIPOLE RIGID ARM	MULTIPOLE RIGID ARM	UP TO 250 VOLTS INC.	250 TO 600 VOLTS INC.		NET	GROSS
6	D.C.	1	6	22 $\frac{1}{2}$		26 $\frac{1}{2}$	31 $\frac{1}{2}$	8 $\frac{1}{4}$	172	232
6	1500-1800 A.C.	2	6	22 $\frac{1}{2}$	17 $\frac{1}{2}$	26 $\frac{1}{2}$	31 $\frac{1}{2}$	17 $\frac{1}{4}$	374	464
6	1500-1800 A.C.	3	6	22 $\frac{1}{2}$	17 $\frac{1}{2}$	26 $\frac{1}{2}$	31 $\frac{1}{2}$	26 $\frac{1}{4}$	516	696
6	1500-1800 A.C.	4	6	22 $\frac{1}{2}$	17 $\frac{1}{2}$	26 $\frac{1}{2}$	31 $\frac{1}{2}$	35 $\frac{1}{4}$	688	928
6 $\frac{1}{2}$	2500-3000 D.C.	1	7 $\frac{1}{4}$	18 $\frac{1}{2}$		28	36	8 $\frac{3}{4}$	185	244
6 $\frac{1}{2}$	2500-3000 D.C.	2	7 $\frac{1}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	28	36	18 $\frac{3}{4}$	370	488
6 $\frac{1}{2}$	2500-3000 D.C.	3	7 $\frac{1}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	28	36	28 $\frac{3}{4}$	555	732
6 $\frac{1}{2}$	2500-3000 D.C.	4	7 $\frac{3}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	28	36	38 $\frac{3}{4}$	740	976
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	1	7 $\frac{3}{4}$	18 $\frac{1}{2}$		28	36	12 $\frac{1}{4}$	230	300
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	2	7 $\frac{3}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	28	36	25 $\frac{3}{4}$	460	600
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	3	7 $\frac{3}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	28	36	39 $\frac{1}{4}$	690	900
6 $\frac{3}{4}$	4000-5000 D.C. up to 250V/line	4	8 $\frac{1}{4}$	18 $\frac{1}{2}$	18 $\frac{1}{2}$	28	36	52 $\frac{3}{4}$	920	1200

* STUD LENGTHS SHOWN BASED ON FOLLOWING SLATE THICKNESSES WHICH ARE RECOMMENDED

FRAME NO.	1 POLE	2 POLE	3 POLE	4 POLE
6	2	2	2	2
6 $\frac{1}{2}$	2	2	2	2 $\frac{1}{2}$
6 $\frac{3}{4}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3

DIMENSIONS OF D.C. 4000-5000 AND 6000 AMPERE 600 VOLT BREAKERS FURNISHED ON REQUEST

FRAME 6 HAS SPADE HANDLE ON SINGLE POLE OR INDEP. ARM MULTIPOLE

FRAME 6 HAS REMOVABLE HANDLE ON RIGID ARM MULTIPOLE

FRAMES 6 $\frac{1}{2}$ AND 6 $\frac{3}{4}$ HAVE REMOVABLE HANDLES ON EITHER SINGLE POLE OR INDEP. OR RIGID ARM MULTIPOLE

ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE USED FOR REFERENCE ONLY
CERTIFIED PRINTS FURNISHED ON REQUEST

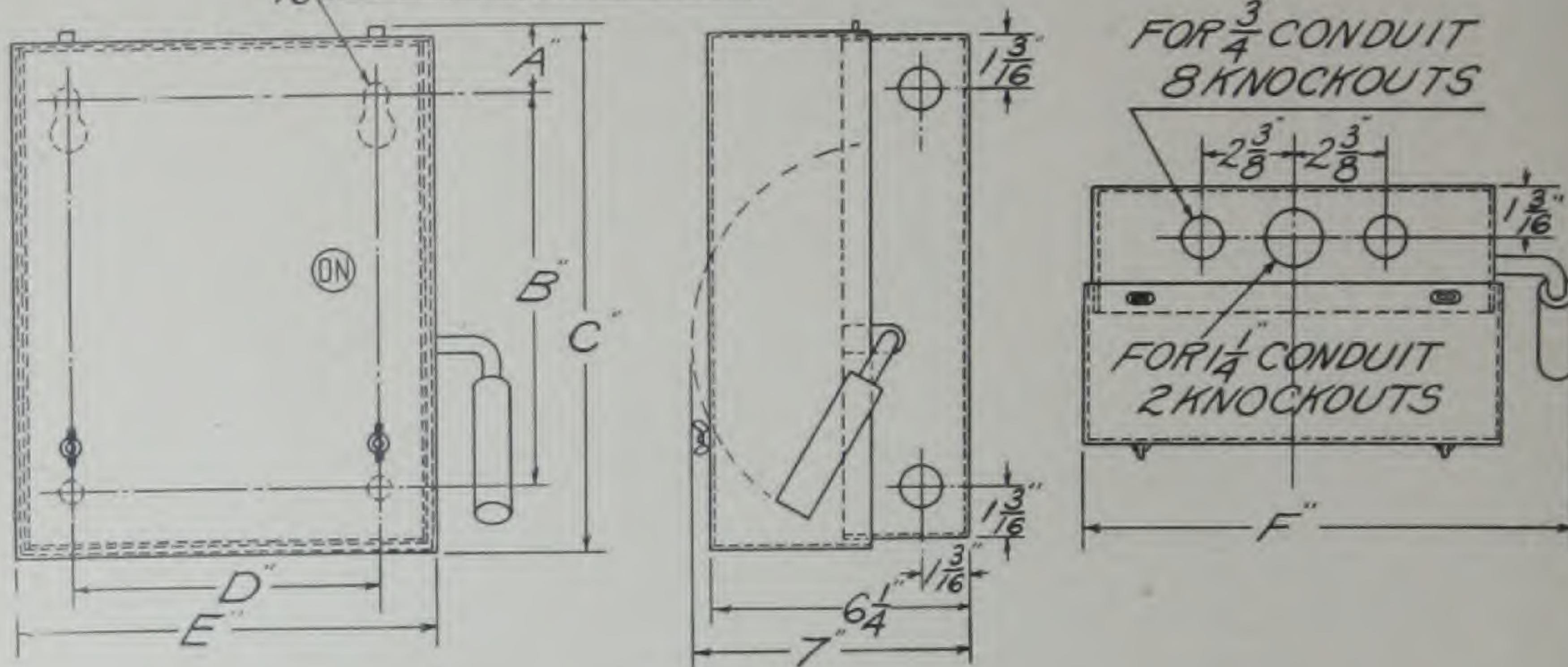
ROLLER-SMITH ENCLOSED TYPE CIRCUIT BREAKERS
TYPE-EAF FREE HANDLE
600 VOLTS AND LESS TWO THREE AND FOUR POLE
80 AMPERES AND LESS

APPROXIMATE OVERALL DIMENSIONS
CERTIFIED PRINTS FURNISHED ON REQUEST

TWO AND THREE POLE TWO COIL

VOLTS	A	B	C	D	E	F
0 - 250	$\frac{7}{8}$	$13\frac{1}{2}$	$15\frac{1}{2}$	$6\frac{3}{4}$	9	11
260-600	$1\frac{7}{8}$	$14\frac{1}{4}$	$18\frac{1}{4}$	$11\frac{3}{4}$	14	16

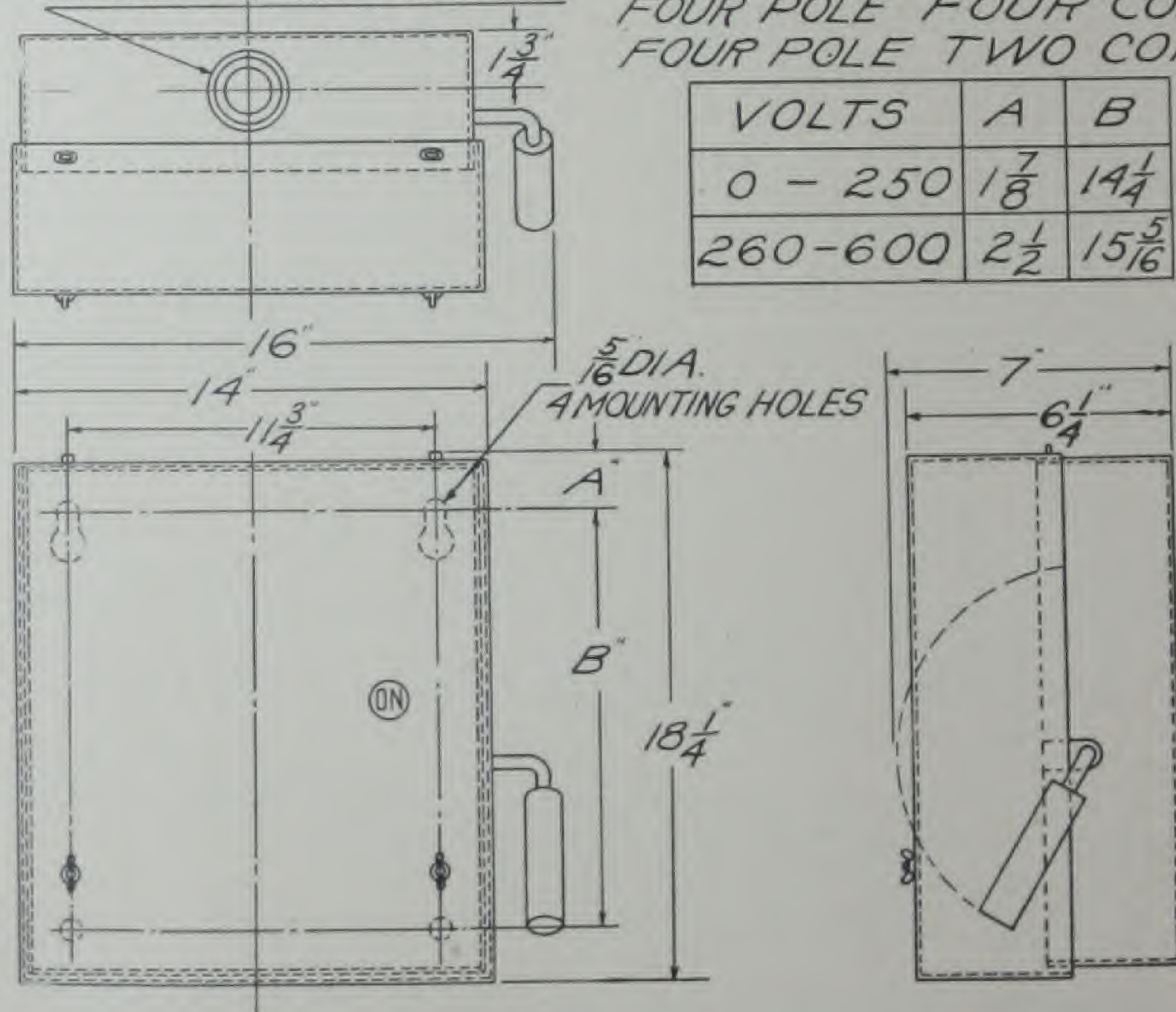
$\frac{5}{16}$ " DIA. 4 MOUNTING HOLES

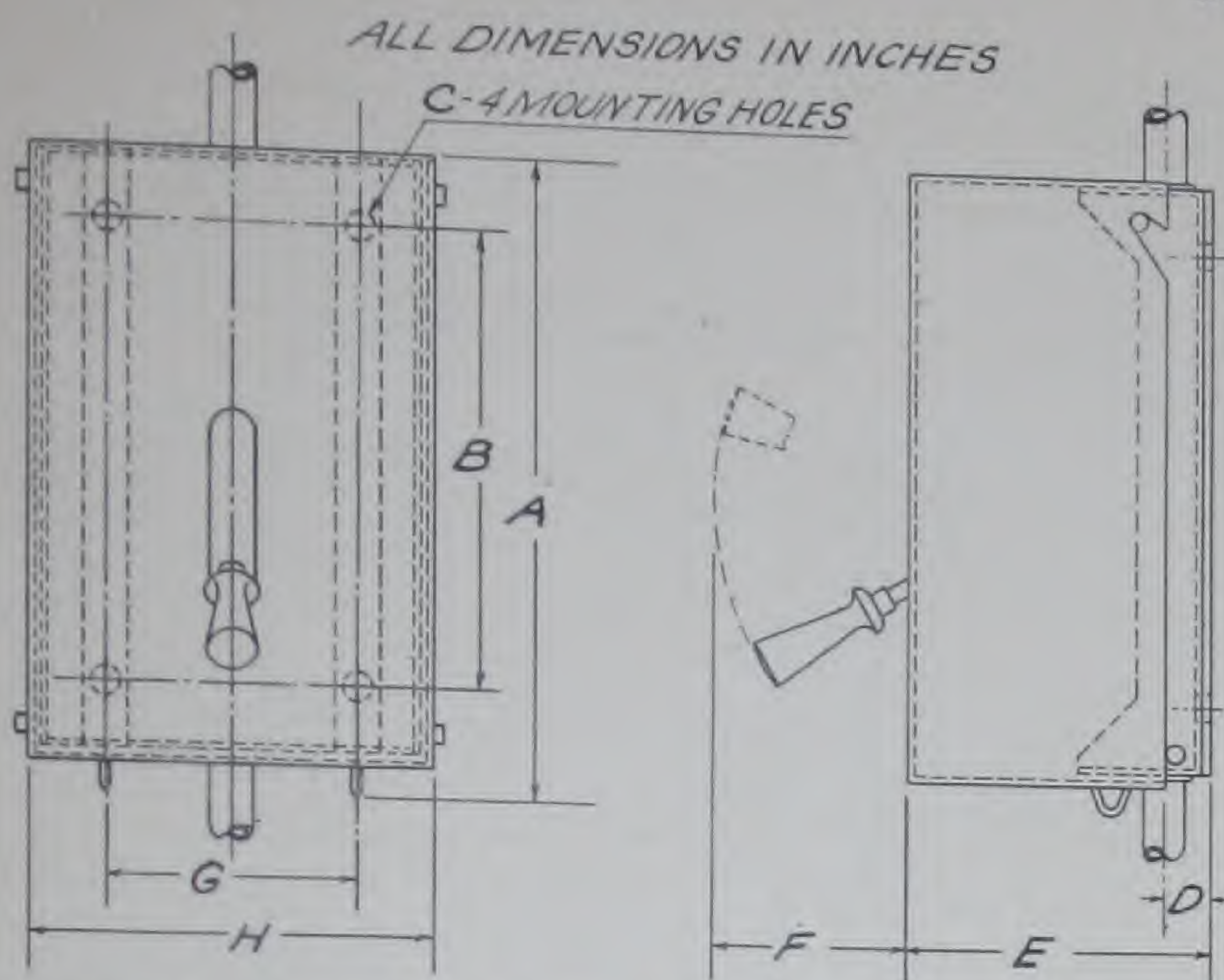


FOR $\frac{3}{4}$ - $1\frac{1}{4}$ & $1\frac{1}{2}$ CONDUIT
KNOCKOUTS TOP & BOTTOM

FOUR POLE FOUR COIL
FOUR POLE TWO COIL

VOLTS	A	B
0 - 250	$1\frac{7}{8}$	$14\frac{1}{4}$
260-600	$2\frac{1}{2}$	$15\frac{5}{16}$





OVERALL DIMENSIONS OF TYPES - ES & EI
ENCLOSED CIRCUIT BREAKERS

WITH OR WITHOUT TIME LIMITS

* FREE HANDLE

▽ NONFREE HANDLE

○ FREE HANDLE SAME AS PLAIN OVERLOAD

† NONFREE HANDLE SAME AS PLAIN OVERLOAD

OVERLOAD & UNDERVOLTAGE
TYPE - ES

OVERLOAD & UNDERVOLTAGE TYPE-ES					*	▽	1 POLE			2 POLE			3 POLE		
AMPERES	A	B	C	D	E	E	F	G	H	F	G	H	F	G	H
0-80	†26½	†21	¾	2¼	10	8½	5	°5½	°8½	5	9	12½	5	14	17½
100-200	30¼	24	7/16	2¼	12½	9¾	5¾	6	9⅝	5¾	13	16⅝	5¾	19	22⅝
300-800	40⅝	35⅞	9/16	3¼	15¼	13¼	8¼	7	12	8¼	13½	18	13½	21½	26

OVERLOAD & UNDERVOLTAGE TYPE - EI

OVERLOAD & UNDERVOLTAGE TYPE-E1							1 POLE		2 POLE		3 POLE	
AMPERES	A	B	C	D	E	F	G	H	G	H	G	H
0-80	16 $\frac{3}{4}$	12 $\frac{1}{2}$	$\frac{5}{16}$	1 $\frac{5}{8}$	5 $\frac{7}{8}$	3	5 $\frac{1}{2}$	8	7 $\frac{1}{2}$	10	11	14
100	22 $\frac{1}{4}$	15	$\frac{3}{8}$	2 $\frac{1}{4}$	8 $\frac{1}{2}$	5	5 $\frac{1}{2}$	8 $\frac{1}{2}$	9	12 $\frac{1}{2}$	14	17 $\frac{1}{2}$

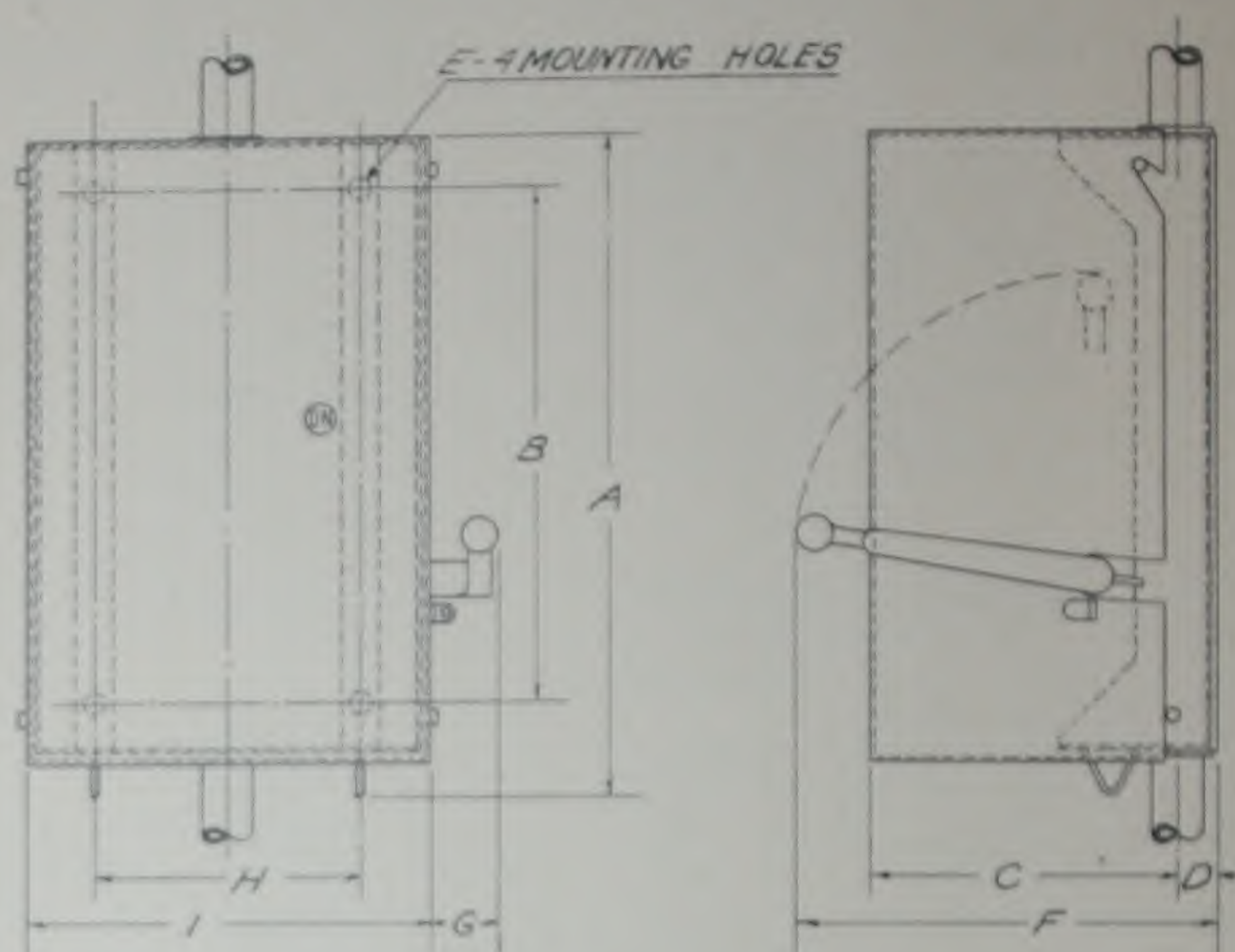
PLAIN OVERLOAD
TYPE - ES

PLAIN OVERLOAD TYPE-ES					*	▽	1 POLE			2 POLE			3 POLE		
AMPERES	A	B	C	D	E	E	F	G	H	F	G	H	F	G	H
0-80	22½	15	¾	2¼	10	8½	5	4½	7½	5	9	12½	5	14	17½
100-200	25¼	19	7/16	2¼	12½	9¾	5¾	6	9⅝	5¾	13	16⅝	5¾	19	22⅝
300-800	33¼	28½	9/16	3¼	15¼	13¼	8¼	7	12	8¼	13½	18	13½	21½	26

PLAIN OVERLOAD TYPE - EI

PLAIN OVERLOAD TYPE-E1							1 POLE	2 POLE		3 POLE		
AMPERES	A	B	C	D	E	F	G	H	G	H	G	H
0-80	16 $\frac{3}{4}$	12 $\frac{1}{2}$	$\frac{5}{16}$	1 $\frac{5}{8}$	5 $\frac{7}{8}$	3	3 $\frac{1}{2}$	6	7 $\frac{1}{2}$	10	11	14
100	22 $\frac{1}{4}$	15	$\frac{3}{8}$	2 $\frac{1}{4}$	8 $\frac{1}{2}$	5	4 $\frac{1}{2}$	7 $\frac{1}{2}$	9	12 $\frac{1}{2}$	14	17 $\frac{1}{2}$

Approximate overall dimensions
Certified prints furnished on request



OVERALL DIMENSIONS TYPE-ESF
ENCLOSED CIRCUIT BREAKERS
WITH OR WITHOUT TIME LIMITS

▽ PLAIN OVERLOAD

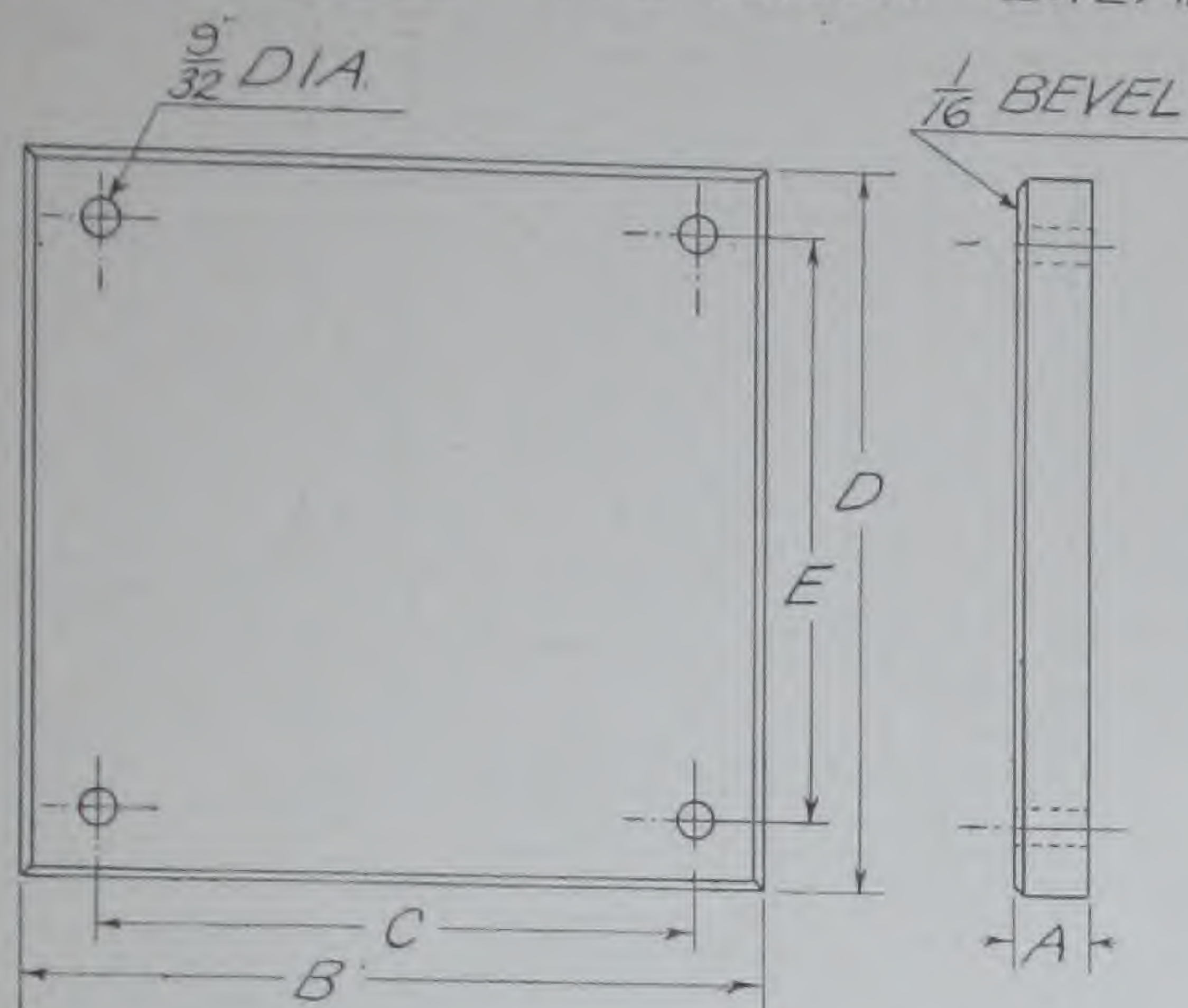
• OVERLOAD & UNDERVOLTAGE

ALL DIMENSIONS IN INCHES

	▽	•									1POLE		2POLE		3POLE	
AMPERES	A	B	A	B	C	D	E	F	G	H	I	H	I	H	I	
0-80	27 $\frac{1}{4}$	21	32 $\frac{1}{4}$	26	11 $\frac{3}{8}$	2 $\frac{1}{4}$	$\frac{3}{8}$	14	3	5	8 $\frac{1}{2}$	11	13	15	18 $\frac{1}{2}$	
100-200	30 $\frac{1}{2}$	24	34 $\frac{1}{2}$	28	13	2 $\frac{1}{4}$	$\frac{7}{16}$	16 $\frac{1}{2}$	3	6	9 $\frac{1}{2}$	11	14 $\frac{1}{2}$	18	23 $\frac{1}{2}$	
300-800	39 $\frac{1}{4}$	34	45 $\frac{1}{4}$	38	15 $\frac{1}{4}$	3 $\frac{1}{4}$	$\frac{7}{16}$	19	3	7	11 $\frac{5}{8}$	15	19 $\frac{1}{2}$	23	27	

Approximate overall dimensions
Certified prints furnished on request

OVERALL DIMENSIONS OF SLATE BASES FOR FRONT
CONNECTED INDUSTRIAL TYPE CIRCUIT BREAKERS



ALL DIMENSIONS IN INCHES

FRAME No	AMPERES	POLES	A	P.O.		O&UV OR S.T.		D	E	F	G
				B	C	B	C				
1	0-80	1	$\frac{3}{4}$	3	2	$4\frac{1}{2}$	$3\frac{1}{2}$	8	7		
1	0-80	2	$\frac{3}{4}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{2}$	8	7		
1	0-80	3	$\frac{3}{4}$	$11\frac{5}{8}$	$10\frac{5}{8}$	$11\frac{5}{8}$	$10\frac{5}{8}$	8	7		
1	0-80	4	$\frac{3}{4}$	$15\frac{3}{4}$	$14\frac{1}{4}$	$15\frac{3}{4}$	$14\frac{1}{4}$	8	$6\frac{1}{2}$		
$2\frac{1}{2}$	100	1	1	$4\frac{1}{2}$	$3\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	8	7	4	$1\frac{5}{8}$
$2\frac{1}{2}$	100	2	1	$10\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$	$9\frac{1}{2}$	8	7	4	$1\frac{5}{8}$
$2\frac{1}{2}$	100	3	1	$15\frac{1}{2}$	14	$15\frac{1}{2}$	14	8	$6\frac{1}{2}$	4	$1\frac{5}{8}$
$2\frac{1}{2}$	100	4	1	21	$19\frac{1}{2}$	21	$19\frac{1}{2}$	8	$6\frac{1}{2}$	4	$1\frac{5}{8}$

P.O. = PLAIN OVERLOAD

UV. = UNDER-VOLTAGE

S.T. = SHUNT TRIP

F = DISTANCE BARRIER EXTENDS ABOVE SLATE
FOR 260 VOLTS AND ABOVE

G = DISTANCE BREAKER EXTENDS ABOVE SLATE

All dimensions are approximate and should be used for reference purposes only.
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ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE:
233 Broadway, NEW YORK

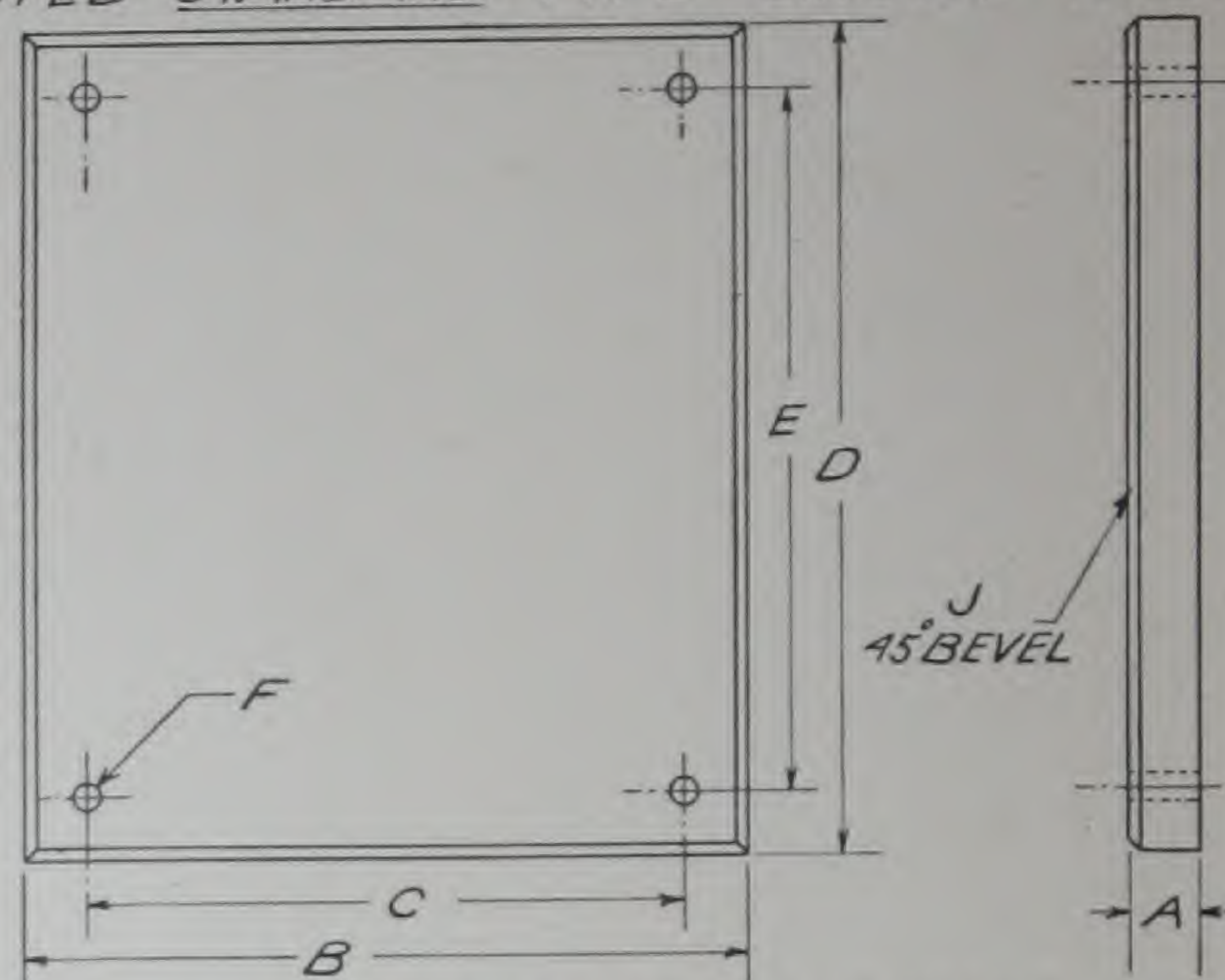


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Bethlehem, Pennsylvania

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Supplement No. 1 to
DATA SHEET DE

OVERALL DIMENSIONS OF SLATE BASES FOR FRONT
CONNECTED STANDARD TYPE CIRCUIT BREAKERS



ALL DIMENSIONS IN INCHES

			PLAIN OVERLOAD					OVERLOAD & UNDERVOLTAGE OR SHUNT TRIP								
FRAME	AMPS	POLES	A	B	C	D	E	B	C	D	E	F	H	I	J	
2	5-10-20-30 45-60-80	1	1	5½	4	11	9½	7	5½	11	9½	9/32	2⅛	¼	1/16	
2		2	1	12	10½	11	9½	12	10½	11	9½	9/32	2⅛	¼	1/16	
2		3	1	16½	14½	11	9½	16½	14½	11	9½	7/16	2⅛	¼	1/16	
2		4	1¼	21	19	11	9	21	19	11	9	7/16	2⅛	¼	1/8	
3	100-150-200	1	1	7	5½	13	11½	7	5½	18	16½	9/32	3⅜	1/8	1/8	
3		2	1	15	13½	13	11½	15	13	18	16	7/16	3⅜	1/8	1/8	
3		3	1¼	22	20¼	13	11¼	22	20	18	16	7/16	3⅜	1/8	1/8	
3		4	1½	28	25½	13	10½	28	25½	18	15½	7/16	3⅜	1/8	3/16	
4	300-400-500	1	1¼	11	8½	18	15½	11	8½	26	23½	7/16	4¼	1/8	1/8	
4		2	1¼	20	17½	18	15½	20	17½	26	23½	7/16	4¼	1/8	3/16	
4		3	1½	28	25	18	15	28	25	26	23	7/16	4¼	1/8	3/16	
4		4	1½	36	33	18	15	36	33	26	23	9/16	4¼	1/8	3/16	
4½	600-800	1	1¼	11	8½	18	15½	11	8½	26	23½	7/16	4¼	1/8	3/16	
4½		2	1¼	20	17½	18	15½	20	17½	26	23½	7/16	4¼	1/8	3/16	
4½		3	1½	28	25	18	15	28	25	26	23	7/16	4¼	1/8	3/16	
4½		4	1½	36	33	18	15	36	33	26	23	9/16	4¼	1/8	¼	
5	1000-1200	1	2	15	12	24	21	14	11	28	25	7/16	5	¼	3/16	
5		2	2	24	21	24	21	21	18	28	25	7/16	5	¼	3/16	
5		3	2	30	26½	24	21	30	26½	28	24½	9/16	5	¼	3/16	
5		4	2	40	36½	24	21	40	36½	28	24½	9/16	5	¼	¼	

H = DISTANCE BARRIERS EXTEND ABOVE TOP OF SLATE (FOR 4 VOLTS AND ABOVE)

I = DISTANCE BREAKER EXTENDS ABOVE TOP OF SLATE

All dimensions are approximate and should be used for reference purposes only.
Certified prints furnished on request.

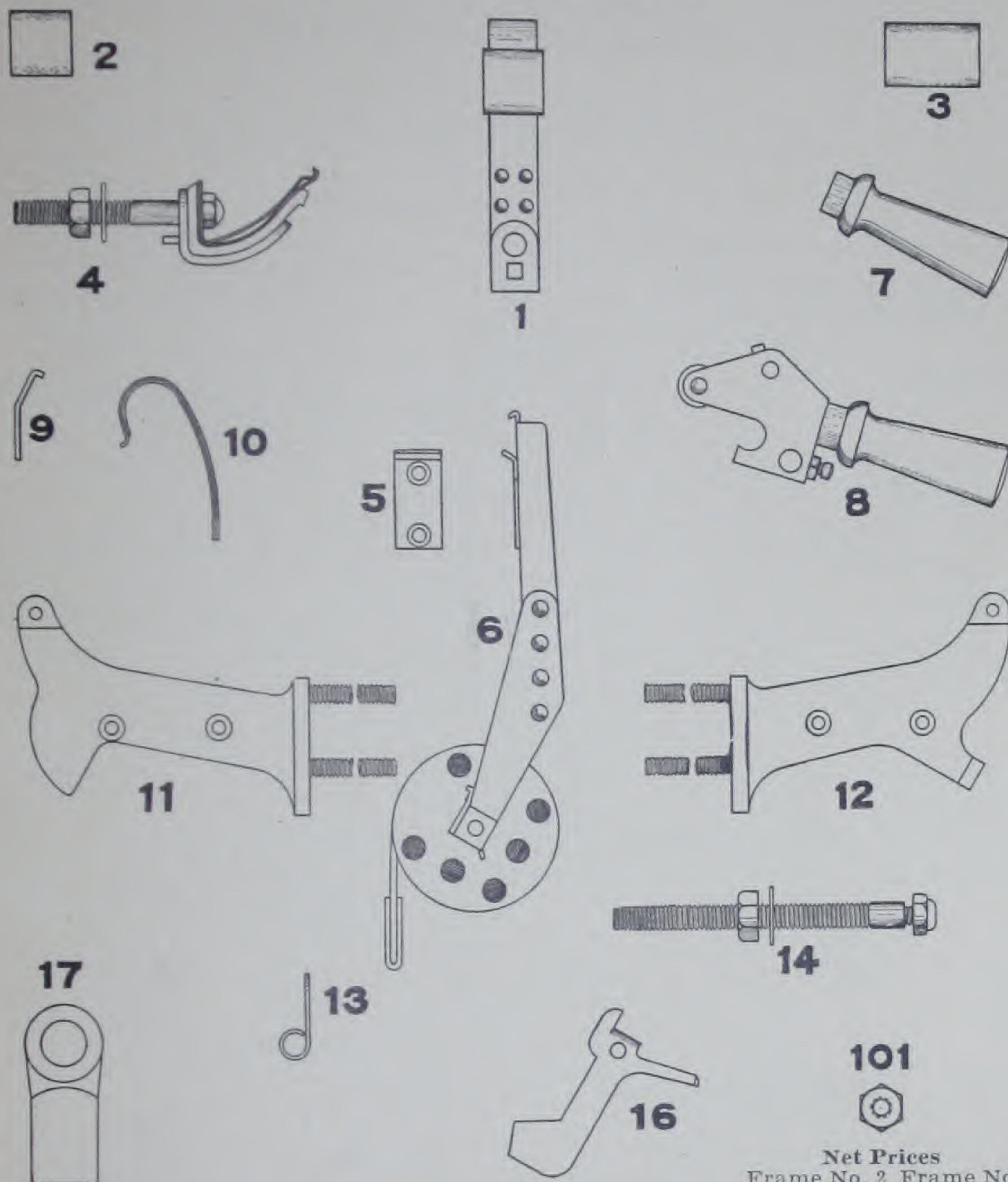
Spare Parts for Roller-Smith Circuit Breakers

When ordering spare parts specify the following: { Piece Number
Ampere Capacity of Circuit Breaker
Serial Number of Circuit Breaker

Standard Type: Capacities 5 to 200 Amperes Inclusive

Group No. 1

PLATE NO. 203



Piece Number	Description	Net Prices	
		Frame No. 2 5-80 Amps. Incl.	Frame No. 3 100-200 Amps. Incl.
1.	Carbon Spring Complete with Carbon.....	\$1.00	\$1.56
2.	Carbon for 250 Volts or less.....	.20	.25
3.	Carbon for over 250 Volts.....	.25	.32
4.	Brush Complete	1.25	2.45
5.	Arm Secondary Contact.....	.25	.50
6.	Arm Complete with Coil, Core and Secondary Contact...	3.32	4.80
7.	Handle .....	.25	.38
8.	Handle Lever Complete with Handle, Roller and Eccentric.	1.50	2.20
9.	Tension Spring Latch.....	.20	.20
10.	Tension Spring.....	.32	.38
11.	Left Housing .....	.63	.95
12.	Right Housing	1.00	1.25
13.	Cable Terminal, 5 to 80 Amps. inclusive.....	.25	—
14.	Coil Stud Complete with Nuts.....	.50	.80
16.	Armature .....	.38	.70
17.	Cable Terminal 80 to 200 Amps. inclusive.....	—	.10
101.	Stud Nut .....	.04	.04

ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus

MAIN OFFICE
233 Broadway, NEW YORK



WORKS
Bethlehem, Penna.

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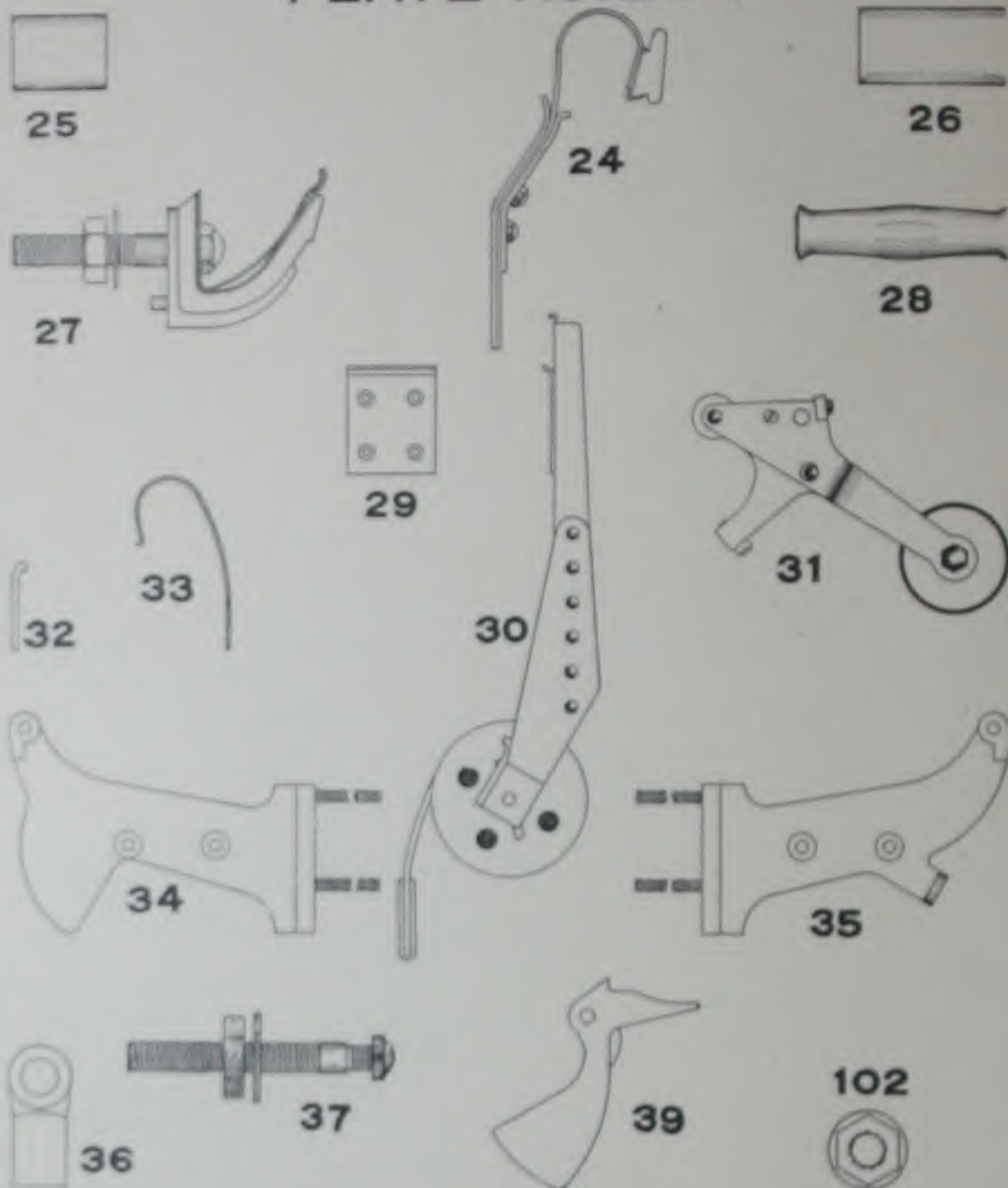
Spare Parts for Roller-Smith Circuit Breakers

When ordering spare parts specify the following: { Piece Number
Ampere Capacity of Circuit Breaker
Serial Number of Circuit Breaker

Standard Type: Capacities 300 to 800 Amperes Inclusive

Group No. 2

PLATE NO. 204



Piece
Number

Description

Net Prices
Frame No. 4 Frame No. 4 1/2
200-500 600-800
Amps. Incl. Amps. Incl.

24.	Carbon Spring Complete with Carbon.....	\$2.80	\$2.80
25.	Carbon for 250 Volts or less.....	.32	.32
26.	Carbon for over 250 Volts.....	.44	.44
27.	Brush Complete.....	5.12	5.75
28.	Handle.....	.28	.28
29.	Arm Secondary Contact.....	.70	.70
30.	Arm Complete with Coil, Core and Secondary Contact....	10.90	13.12
31.	Handle Lever Complete with Roller, Handle, Eccentric and Buffer.....	3.38	3.38
32.	Tension Spring Latch.....	.32	.32
33.	Tension Spring.....	.70	.70
34.	Left Housing.....	1.56	1.56
35.	Right Housing.....	1.97	1.97
36.	Cable Terminal.....	1.70	1.82
37.	Coil Stud Complete with Nuts.....	1.06	1.02
38.	Armature.....	1.13	1.13
102.	Stud Nut.....	.18	.18

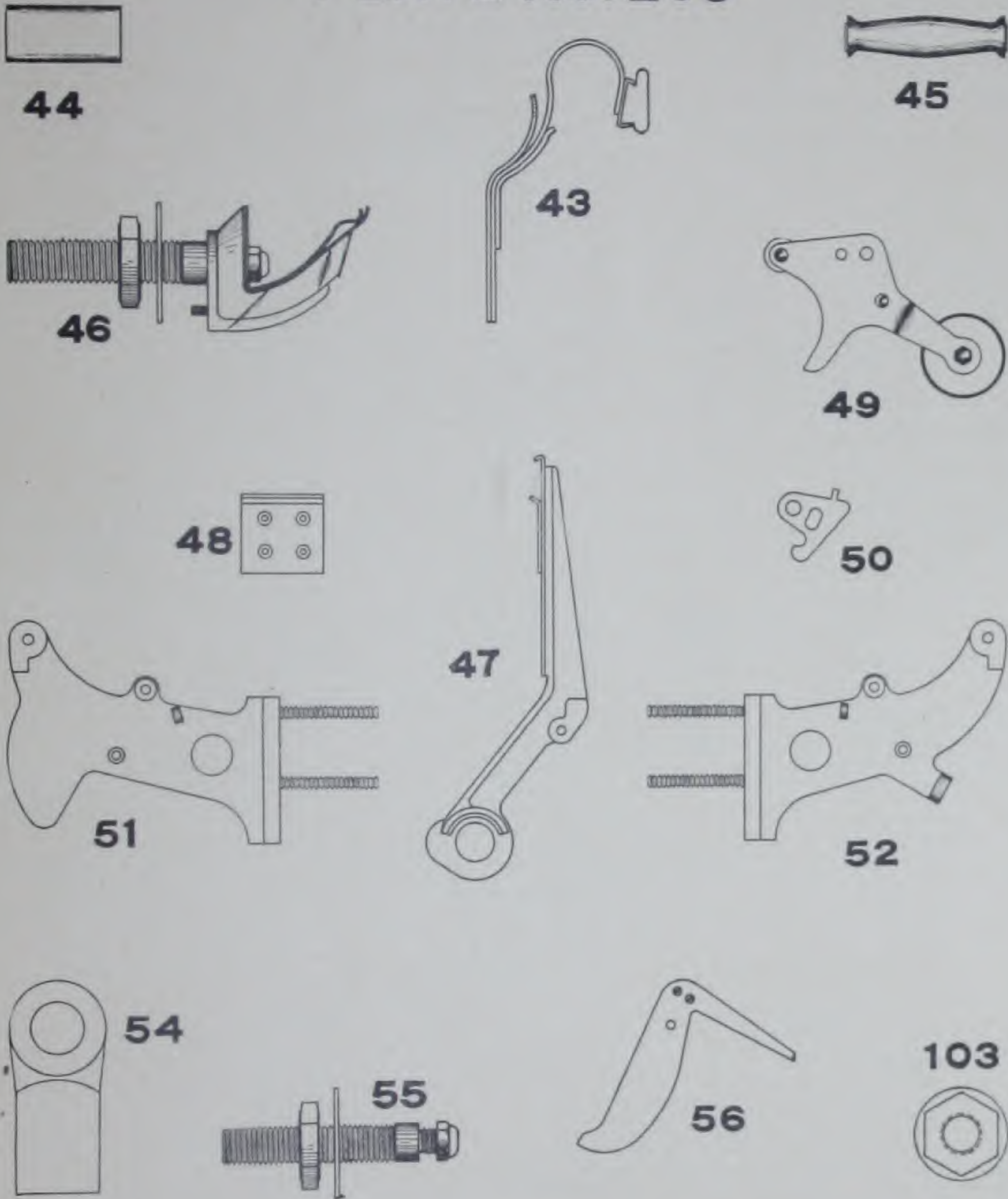
Spare Parts for Roller-Smith Circuit Breakers

When ordering spare parts specify the following: { Piece Number
Ampere Capacity of Circuit Breaker
Serial Number of Circuit Breaker

Standard Type: Capacities 1000 to 1200 Amperes Inclusive

Group No. 3

PLATE NO. 205



Piece Number	Description	Net Prices Frame No. 5
43.	Carbon Spring Complete with Carbon.....	\$3.83
44.	Carbon (600 Volts or less).....	.44
45.	Handle .....	.38
46.	Brush Complete	10.90
47.	Arm with Contact and Secondary Contact.....	8.75
48.	Secondary Contact	1.38
49.	Handle Lever Complete with Handle, Roller and Eccentric.....	4.95
50.	Buffer Latch .....	.38
51.	Left Housing	3.56
52.	Right Housing	4.32
54.	Cable Terminal	1.95
55.	Coil Stud Complete with Nuts.....	3.63
56.	Armature	2.95
103.	Stud Nut .....	.22

Spare Parts for Roller-Smith Circuit Breakers

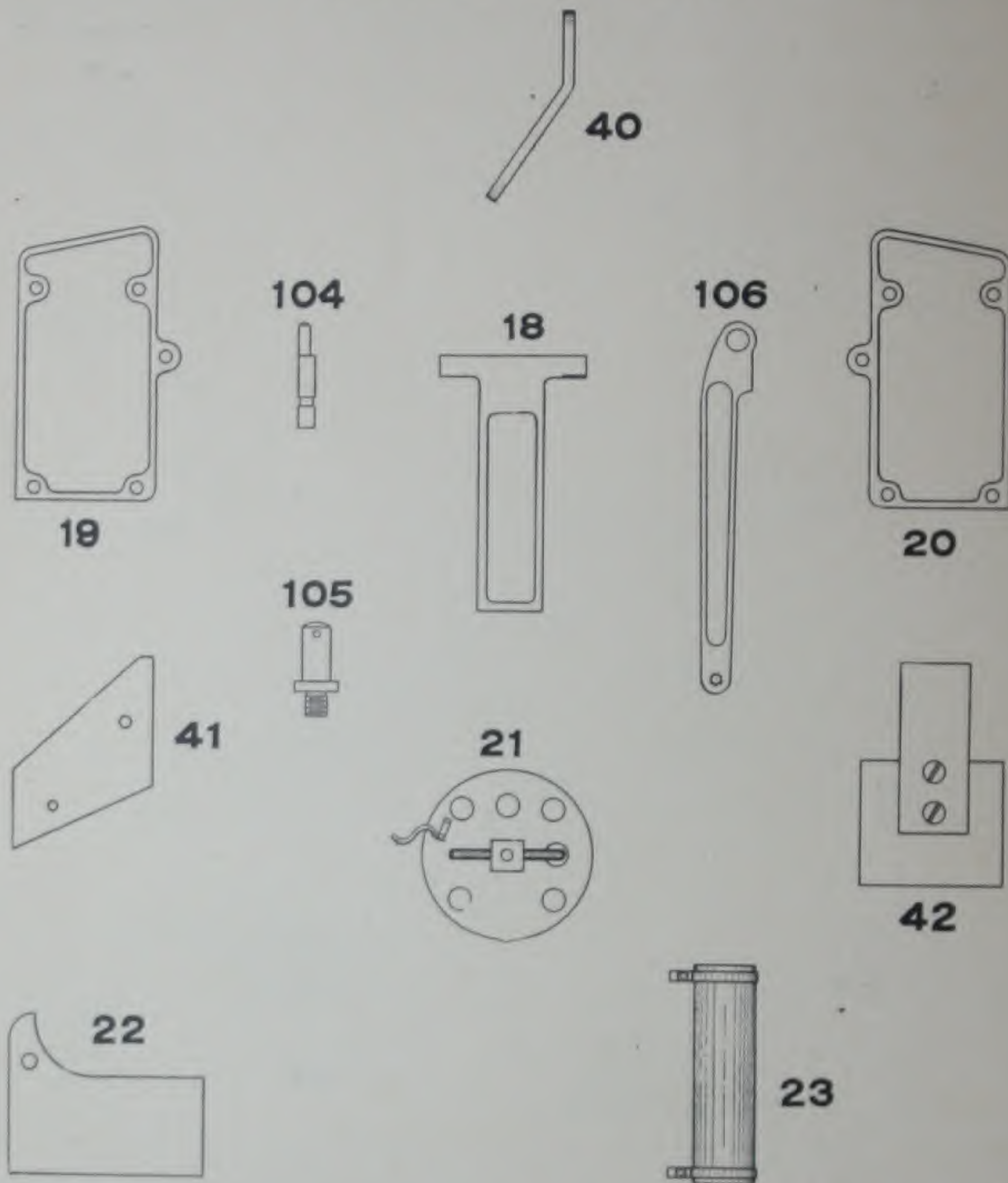
When ordering spare parts specify the following: { Piece Number
Ampere Capacity of Circuit Breaker
Serial Number of Circuit Breaker

Standard Type: Capacities 5 to 600 Amperes Inclusive

Parts for Shunt Trip and Under-Voltage Features

Group No. 4

PLATE NO. 202



Piece Number	Description	Net Prices		
		Fr. No. 2	Fr. No. 3	Fr. No. 4
18.	Armature Extension	\$.70	\$.82	\$1.13
19.	Left Housing Extension .....	.70	.75	1.20
20.	Right Housing Extension .....	.70	.75	1.20
21.	Shunt Trip or Under-Voltage Coll.	4.62	5.32	6.63
22.	Under-Voltage Armature	1.38	1.38	1.70
23.	Resistance Tubes	Prices on Application		
40.	Handle Lever Extension .....	.70	.70	.82
41.	Shunt Trip Pole Piece	1.00	1.13	—
42.	Shunt Trip Armature	1.38	1.38	—
104.	Undervoltage Eccentric .....	.20	.20	.30
105.	Undervoltage Tripping Arm Hinge Pin .....	.15	.15	.25
106.	Undervoltage Tripping Arm .....	.60	.75	1.25

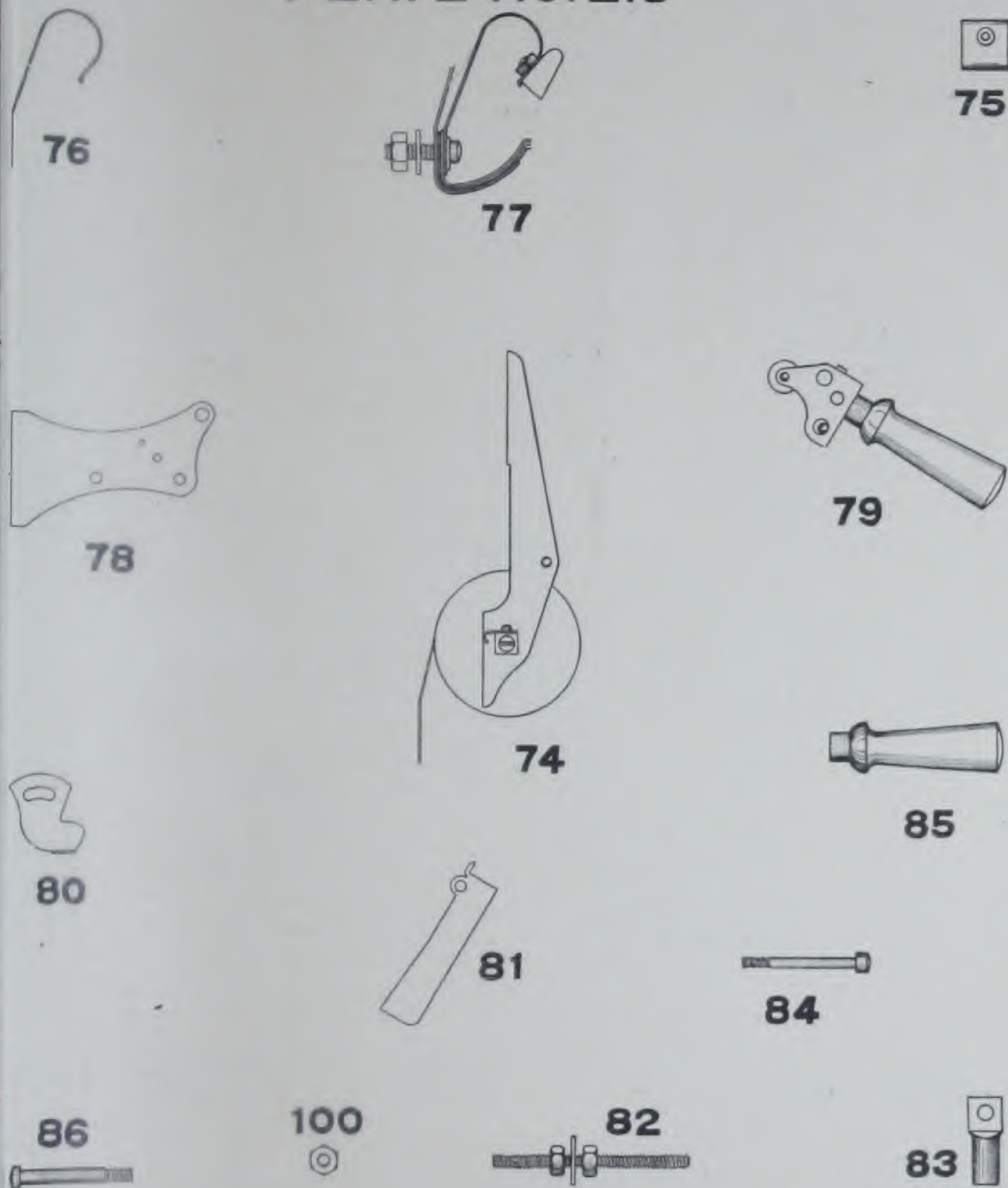
Spare Parts for Roller-Smith Circuit Breakers

When ordering spare parts specify the following: { Piece Number
Ampere Capacity of Circuit Breaker
Serial Number of Circuit Breaker

Industrial Type: Capacities 3 to 45 Amperes Inclusive

Group No. 5

PLATE NO. 219



Piece Number	Description	Net Prices
4.	Arm Complete with Coll.	\$1.95
5.	Carbon	.20
6.	Carbon Spring	.32
7.	Brush Complete with Carbon, Springs and Stud	.82
8.	Housing	.95
9.	Handle Lever Complete with Roller and Eccentric	.95
0.	Armature Stop	.32
1.	Armature	.32
2.	Coll Stud Complete with Nuts	.32
3.	Cable Terminal	.25
4.	Screw for holding Arm or Handle Lever in Housing	.20
5.	Handle	.25
6.	Screw for holding Armature in Housing	.20
0.	Stud Nut	.02

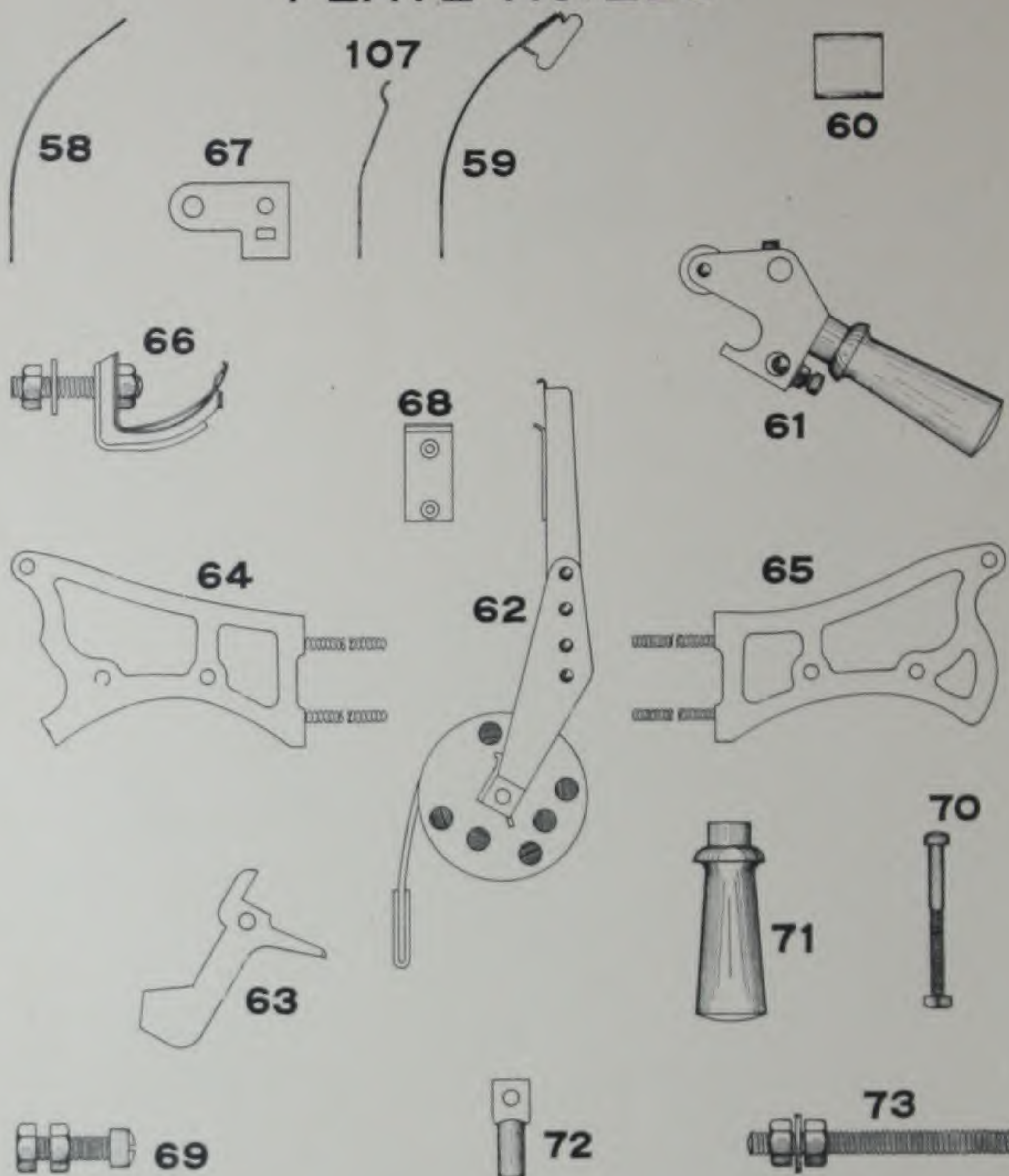
Spare Parts for Roller-Smith Circuit Breakers

When ordering spare parts specify the following: { Piece Number
Ampere Capacity of Circuit Breaker
Serial Number of Circuit Breaker

Industrial Type: Capacities 60 to 100 Amperes Inclusive

Group No. 6

PLATE NO. 220



Piece Number	Description	Net Prices
58.	Carbon Spring Support	\$.44
59.	Carbon Spring Complete with Carbon .....	.50
60.	Carbon .....	.20
61.	Handle Lever Complete with Roller and Eccentric	1.20
62.	Arm Complete with Coil, Core and Contact	2.75
63.	Armature .....	.32
64.	Right Hand Housing .....	.63
65.	Left Hand Housing .....	.63
66.	Brush Complete	1.00
67.	Brush Plate .....	.32
68.	Arm Secondary Contact .....	.20
69.	Stud with Nuts for Wall Mounting .....	.32
70.	Housing Screw .....	.13
71.	Handle .....	.25
72.	Cable Terminal .....	.25
73.	Stud with Nuts for Switchboard Mounting .....	.38
107.	Carbon Spring Support .....	.12

Circuit Breaker Cable Terminals
1500 TO 5000 AMPERES

NOTE—When Ordering Cable Terminals Specify:

- 1 Size and number of cables,
- 2 Thickness of switchboard,
- 3 Whether terminals are to go on brush terminal or coil terminal or both,
- 4 Whether cables are to be led up or down.

Frame 6 - 1500-2000 Amps.	Brush Terminal	A	2 1/2"	2 3/4"
		B	1 1/2"	2 1/2"
		C	5 1/2"	6 1/2"
		D	3 1/2"	3 3/4"
		E	2 1/2"	2 3/4"
		F	2 1/2"	2 3/4"
		G	5 1/2"	6 1/2"
		H	2 1/2"	2 3/4"
Coil Terminal	A	2 1/2"	2 3/4"	
	B	1 1/2"	2 1/2"	
	C	6 1/2"	7 1/2"	
	D	3 1/2"	4 1/2"	
	E	2 1/2"	2 3/4"	
	F	2 1/2"	2 3/4"	
	G	5 1/2"	6 1/2"	
	H	2 1/2"	2 3/4"	
Frame 6 1/2 - 2500-3000 Amps.	Brush Terminal	A	2 1/2"	2 3/4"
		B	1 1/2"	2 1/2"
		C	5 1/2"	6 1/2"
		D	4 1/2"	4 3/4"
		E	2 1/2"	2 3/4"
		F	2 1/2"	2 3/4"
		G	5 1/2"	6 1/2"
		H	2 1/2"	2 3/4"
Coil Terminal	A	3"	3 1/2"	
	B	1 1/2"	2 1/2"	
	C	7 1/2"	8 1/2"	
	D	4 1/2"	5 1/2"	
	E	2 1/2"	2 3/4"	
	F	2 1/2"	2 3/4"	
	G	5 1/2"	6 1/2"	
	H	2 1/2"	2 3/4"	
Frame 7 - 3500-5000 Amps.	Brush Terminal	A	3 1/2"	3 3/4"
		B	1 1/2"	2 1/2"
		C	6 1/2"	7 1/2"
		D	-	-
		E	2 1/2"	2 3/4"
		F	2 1/2"	2 3/4"
		G	6 1/2"	7 1/2"
		H	2 1/2"	2 3/4"
Coil Terminal	A	3 1/2"	3 3/4"	
	B	1 1/2"	2 1/2"	
	C	7 1/2"	8 1/2"	
	D	-	-	
	E	2 1/2"	2 3/4"	
	F	2 1/2"	2 3/4"	
	G	6 1/2"	7 1/2"	
	H	2 1/2"	2 3/4"	

NET PRICES

For Cables
up to
2,000,000 cm.

Piece
Number

1.....	\$11.50
2.....	14.50
3.....	22.75
4.....	11.00
5.....	15.75
6.....	22.25
7.....	11.25
8.....	14.00
9.....	22.00

NET PRICES

For Cables
up to
2,000,000 cm.

Piece
Number

10.....	\$12.25
11.....	14.50
12.....	22.25
13.....	11.25
14.....	12.25
15.....	13.75
16.....	13.75
17.....	12.00
18.....	13.25

Circuit Breaker Cable Terminals

1500 TO 3000 AMPERES

NOTE—When Ordering Cable Terminals Specify:

- 1 Size and number of cables,
- 2 Thickness of switchboard,
- 3 Whether terminals are to go on brush terminal or coil terminal or both,
- 4 Whether cables are to be led up or down.

Frame 6 1500-2000 Amps.	Brush Terminal			19	20	21	Side View
	A	B	C				
Coil Terminal	D	E	F				
	G	H	I				
Frame 6 2500-3000 Amps.	Brush Terminal			22	23	24	Side View
	A	B	C				
Coil Terminal	D	E	F				
	G	H	I				
Frame 6 2500-3000 Amps.	Brush Terminal			25	26	27	Side View
	A	B	C				
Coil Terminal	D	E	F				
	G	H	I				
Frame 6 2500-3000 Amps.	Brush Terminal			28	29	30	Side View
	A	B	C				
Coil Terminal	D	E	F				
	G	H	I				

NET PRICES

Piece Number	For Cables up to 2,000,000 cm.
19	\$14.50
20	15.75
21	12.50
22	12.50
23	14.75
24	14.50

NET PRICES

Piece Number	For Cables up to 2,000,000 cm.
25	\$14.50
26	16.00
27	18.50
28	20.75
29	18.25
30	22.00



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